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ADVANCED MATERIALS

FRG: Fraunhofer Develops Organically Modified Ceramics

90MI0239 Munich FRAUNHOFER BERICHTE in German No 2, 1990 pp 64-67

[Article by Dr. Klaus Greiwe, Dr. Gerhard Schottner, Fraunhofer Institute of Silicate Research (ISC) at Wuerzburg]

[Excerpts]

Background

Composite materials have enormously extended the spectrum of conventional materials. Ideally, different substances are combined on a molecular basis to form a single material. The sol-gel process presents advantages as a method for synthesizing composite materials. This process makes it possible to combine the properties of inorganic (e.g., ceramic) and organic substances in one material.

1. Development of New Materials (ORMOCER's)

The Franuhofer Institute of Silicate Research (ISC) in Wuerzburg has been working for several years on the development of new materials by the sol-gel process. These organically modified, nonmetallic, inorganic substances are called ORMOCER's from the Anglo-Saxon term "organically modified ceramics." During production, a hydrolysis and polycondensation process is used to convert liquid metalliferous compounds, primarily silicic acid esters and their derivatives, although hydroxides or easily decomposable salts of the desired elements may also be used, into materials with an inorganic, oxidic network.

The choice of the organic groups is not restricted to noncreative alkyl and aryl groups but also includes functional groups. In principle, condensation of the hydrolyzed metallic alcoholates to form an inorganic network may therefore be accompanied by the simultaneous formation of an organic polymer matrix. Owing to the large number of possible combinations of different basic components, and because the properties of the product are greatly influenced by the production process, this system of materials presents a very wide range of variations. This makes it possible to produce and adapt coating materials in particular to meet widely differing specifications.

Initial product developments showed that ORMOCER coating systems presented outstanding abrasion and scratch resistance, which contributed to the successful development of a hard coating for synthetic spectacle lenses made of CR [chloroprene resin] 39. Its market launch was a resounding success and led to many new projects on scratch and abrasion resistant coatings.

The ISC is receiving a constantly increasing number of inquiries about similar coating materials for nonrigid plastic substrates (for example, polycarbonate, polymethyl methacrylate, polyester, polyurethane, polyamides, etc.) and metallic surfaces (for example, brass, aluminum, silver, and so on). Many of these inquiries relate even to finished surfaces that require an additional, mechanical protective coating (for example, laminated plastic foils, galvanized metal surfaces, and vapor-plated glass substrates). It is emerging that, in addition to mechanical surface protection with good bond strength to the substrate concerned, an increasing number of further requirements are being set, the most recurrent being the following:

- Chemical resistance (to air humidity and chemicals such as detergents)
- A high degree of transparency in the visible spectral range (particularly for optical applications such as reading aids, and for decorative purposes such as acrylic glass processing or colored metal surfaces)
- Adequate UV [ultraviolet] stability (for outdoor applications such as plastic automobile parts)
- Thermal stability (for example, applications on polymer foils for copying purposes)
- Diffusion-inhibiting effect (low permeability to water vapor and oxygen, low hydrocarbon permeation)
- Corrosion-inhibiting effect (in addition to acting as a water vapor barrier, the coating should ideally inhibit the diffusion of other corrosive media such as SO_2 or H_2S)
- Antistatic effect (low surface resistance)
- Anticondensation effects (for example, for glass as used in motorcycle helmet visors, etc.)

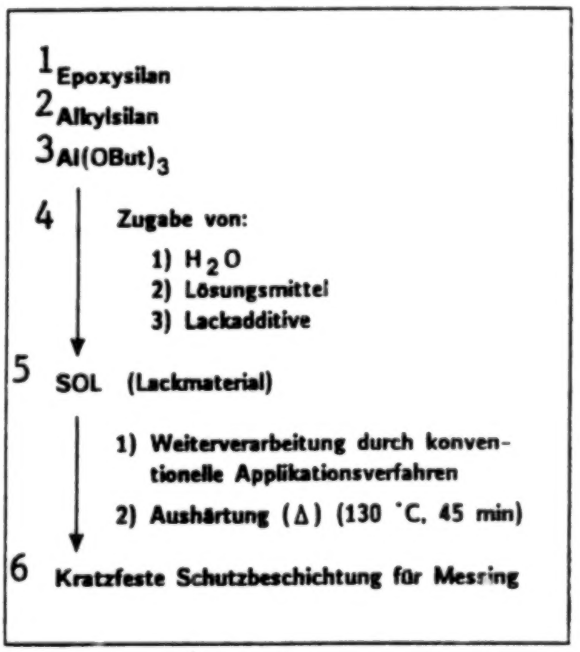


Figure 1: Flow Chart for the Production of a Mechanically Stable Protective Coating for Brass Surfaces

Key: 1. Epoxy hydrosilicon—2. Alkyl hydrosilicon—3. $Al(OBut)_3$ —4. Addition of: 1) H_2O, 2) Solvent, 3) Lacquer additives —5. SOL (lacquer material), 1) Further processing by conventional application methods, 2) Hardening (delta) (130°C, 45 minutes)—6. Scratch-proof protective coating for brass

2. ORMOCER-Based Coating Systems

Owing to their wide range of variations, the ORMOCER-based coating systems developed at the institute provide a good starting point for addressing these numerous requirements. However, it has turned out that adapting and improving coating systems to meet new specifications also requires the relevant development work. The ISC has thus developed a number of versions of these coatings.

3. Protective Lacquering for Metal Surfaces

One of the lines of development for protective coatings was directed toward developing a protective lacquer system for brass surfaces to perform the dual function of a mechanical protection (scratch and abrasion resistance) and an adequate protection against corrosion (chemical resistance). The coating also had to be suited to outdoor applications.

Based on the hard coating developed for the CR 39 spectacle lenses, a distinct improvement in UV stability was obtained by incorporating Al_2O_3 instead of the TiO_2 originally used. The incorporation of hydrophobic groups considerably improved condensation stability. The chosen coating system proves to have distinctly higher scratch hardness and abrasion resistance than conventional protective lacquers. Table 1 lists some of the properties of the recently developed coating system.

Subsequent work was aimed at achieving efficient lacquer application using the paint spraying technique. It emerged from this work that the lacquer formulation had to be modified to avoid gel defects. Propyl hydrosiiicon was replaced with vinyl hydrosilicon. A blend of butanol and 2-ethoxyethanol or 2-butoxyethanol also had to be used as a solvent. Good optical quality can be achieved by applying the new system with a spray gun. Figure 1 shows the flow chart for the production and application of the lacquer in the new specification. The samples lacquered with the new ORMOCER system using a spray-gun gave better results in a 5-day salt spray test than parts coated with a conventional expoxy lacquer. Unlike the epoxy lacquer, the OMOCER- coated samples showed no corrosive infiltration of the lacquer film in the grid section.

Initial results indicate that this coating can be used with other metals as well (aluminum, silver, nickel, etc.). However, its bond- strength to these metals still requires improvement.

As shown in table 1, the potlife for the aluminiferous lacquer is approximately eight hours. To ensure regular supplies for production, therefore, an automatic production plant had to be designed to synthesize the lacquer requirement from day to day. [passage omitted] The lacquer is synthesized in two cooled stirrer tanks, which are fed from supply tanks via automatic, computer-controlled metering pumps. The highly exothermic hydrolysis of the basic compounds is controlled by dosing the requisite quantity of water in relation to the temperature.

1	chemische Zusammensetzung	GTMO PTMO Al-tri-sec-butylat AMEO
2	Topfzeit	ca. 8 h
3	Kratzfestigkeit*	8 g
4	Abriebbeständigkeit**	1-2%
5	BEWITTERUNGSTESTS	
6	UV-Stabilität	stabil nach Xenotest (336 h)
7	Salzsprühtest	keine Korrosion nach 240 h

8 * Belastung eines Vickers-Diamanten, bei der beim Ziehen über die Substratoberfläche unter dem Mikroskop erstmalig ein erkennbarer Kratzer verbleibt
**nach DIN 52 347 (Streulichtanteil nach 100
9 Zyklen Belastung mit dem Taber Abraser)

Table 1: Properties of an Aluminiferous ORMOCER Lacquer

Key: 1. Chemical composition—2. Potlife [Topfzeit] approximately eight hours—3. Scratch resistance—4. Abrasion resistance—5. Weather exposure tests—6. UV stability, stable according to Xenotest (336 hours)—7. Salt spray test, no corrosion after 240 hours—8. *Load on a Vickers diamond that first leaves a scratch visible under the microscope when drawn across the substrate surface—9. **According to DIN [German industrial Standard] 52 347 (proportion of scattered light after 100 load cycles with the Taber abraser)

To reduce lacquer wastage, the next goal is to replace the conventional spraying technique with high-speed electrostatic rotary atomization. The electrical field guides the droplets toward the substrate, and wastage (overspray) can be substantially reduced. However, owing to the change in droplet size distribution that high-speed rotary atomization brings, the optimum parameters worked out for the conventional spray gun technique cannot be directly transposed. Current development

1 Thermisch (130°C) und UV-gehärtete Schutzschichten für Wärmedämmgläser			
	2 Abriebverhalten*	3 KK**	4 Xenotest (336 h)
System A	2,3 %	5 stabil	keine Vergilbung
System B	1,7 %	stabil	keine Vergilbung
System C	1,4 %	stabil	keine Vergilbung
System D	3,7 %	stabil	keine Vergilbung

6 UV-gehärtete Schutzschichten auf Al-bedampftem Polycarbonat (Kfz-Spiegel, CDs etc.)			
	2 Abriebverhalten*	3 KK**	7 Xenotest
System E	1,2 %	8 stabil	–

9* nach DIN 52 347 (Streulichtanteil nach 100 Zyklen Belastung mit dem Taber Abraser)
10**nach DIN 50 017 (Kondenswasser-Prüfklima, KK = Konstantklima)

Table 2: Abrasion Resistances and Weather Exposure Behavior of Scratch-Proof Coatings for Metallized Surfaces

Key: 1. Heat- (130°C) and UV-hardened protective coatings for heat insulation glass—2. Abrasion behavior—3. Constant climate—4. Xenotest (336 hours)—5. stable, no yellowing—6. UV- hardened protective coatings on Al-vapor plated polycarbonate (automobile mirrors, compact discs, etc.)—7. Xenotest—8. stable—9. *According to DIN 52 347 (proportion of scattered light after 100 load cycles with the Taber abraser—10. **According to DIN 50 017 (condensation test climate).

work involves studying the influence of various basic compounds, solvents, and lacquer additives on processability by the spray technique.

4. Scratch-Proof Coatings for Metallized Surfaces

The use of modern coating technologies (PVD [plasma vapor deposition], CVD [chemical vapor deposition], and sputter methods) to render glass and plastic surfaces functional is now state-of-the-art. Applications are found in the building industry (for example, heat- insulating glass), the automobile industry (for example, automobile mirrors), and the information technology sector (for instance, compact discs).

In most cases the coatings applied present two decisive disadvantages:

- Low mechanical stability, i.e., they are easily scratched, and/or low abrasion resistance
- Low corrosion resistance, i.e., they show signs of degradation (oxidation, peeling) after exposure to moisture, solvents, etc.

ORMOCER-based protective coatings have been developed for surfaces of this type. In addition to good mechanical strength (as demonstrated by abrasion testing to DIN 52 347), they present exceptional transparency and withstand exposure to corrosive media (condensation test climate according to DIN 50 017). Good stability was also found in weather exposure tests (e.g., Xenotest 250 T).

Table 2 summarizes the results obtained with heat- and UV-hardened systems.

5. Diffusion Barrier for Hydrocarbons

For manufacturing and economic reasons, automobile tanks are increasingly made of polyethylene or polypropylene. However, the high rate of fuel permeation poses problems. A feasibility study showed that ORMOCER coatings on polyethylene substantially reduced its permeability to hydrocarbons. [passage omitted] Corona treatment decisively improved the bond strength of the ORMOCER coating to polyethylene, which is homopolar. F_2 treatment of polyethylene also activates the surface and thus produces a marked improvement in the bond strength of the coating materials.

AEROSPACE, CIVIL AVIATION

Construction of European Transsonic Windtunnel Begun

90WS0051A Duesseldorf VDI-NACHRICHTEN in German 11 May 90 p 47

[Article by Rudolf Bonk: "Europe to Maintain Lead in Aircraft Construction With Transsonic Windtunnel;

Four EC Countries Build Pathbreaking High-Tech Facility in Koeln for 650 Million DM"]

[Text] Four European countries intend to guarantee their lead in civil aircraft construction by building a joint windtunnel. Further advances in aircraft design are therefore necessary. The European Transsonic Windtunnel (ETW), which operates in the low-temperature range using nitrogen, is designed to create the corresponding simulation opportunities. The foundation stone for this high-tech project was laid on 15 May in Koeln-Porz by representatives from the FRG, France, the U.K., and the Netherlands.

Graham L. Harris, director general and chairman of ETW, Ltd., explained to VDI-Nachrichten that the structural design of the windtunnel and the low-temperature process represent supreme achievements in today's high technology. The ETW is the first windtunnel of this type in Europe. According to Harris, its design and technology are "the result of several thousand engineer hours and considerable financial expense."

Construction and operation costs alone for the first few years will amount to 650 million DM. Because going it alone in the aerospace industry no longer guarantees success, the FRG, France, the U.K, and the Netherlands have joined forces in this area as well and are sharing the cost of the project, which was launched in Koeln-Porz on 15 May. After the initial phase, however, ETW, Ltd., which was founded in 1988, plans to use its own resources to finance the operation, so that the facility is not open to any interested party and its services are paid for by the users.

The importance of this facility becomes clear through a comparison of current and older types of aircraft, for instance the Airbus and the first generation of jet aircraft. Although the form does not undergo any immediately obvious noteworthy changes, the Airbus not only uses 30 to 40 percent less fuel, but it is also faster. This is due to the many detailed developments in the body and wings, as well as to considerable improvements in the power unit. The ETW is now to make further body optimizations possible.

In fact, the planned wind tunnel, of which construction began with the laying of the foundation stone, should allow more exact insights into the flow relationships of the aircraft, for two reasons: On the one hand, the process technology offered here guarantees that the model experiments are realistic and thereby transferable to actual circumstances. On the other hand, the ETW's speeds of up to Mach 1.3 can cover the particularly important transsonic range near the speed of sound (Mach 1).

Basically, the simulation quality of a windtunnel is determined by the speed value and by the so-called Reynold's number. The Reynold's number itself is independent of the aircraft length, the flow rate, and the density and viscosity of the flow medium. It is for this reason that measuring results in the past were not necessarily representative, because, as a result of the small measuring scale, the Reynold's number of the model and the original did not match.

So that the reduction scale of the model no longer presents an obstacle, the flow medium is no longer air, but nitrogen at a temperature of -150 to -180 degrees Centigrade. This measure not only raises the density but reduces the viscosity, so that the parameters of the model experiments come very close to reality. The low temperatures are not intended to imitate the low temperatures at high flight altitudes, but to produce comparable Reynold's numbers from the model and the actual aircraft through changes in the medium.

Outside air would be unsuitable as a flow medium with these temperatures, because it would produce condensation. The operators therefore had to turn to nitrogen, whereby the demand for liquid nitrogen is enormous: Up to 250 kg must be injected per second in order to keep the temperature constant.

The high velocity of the ETW up to Mach 1.3 also allows more reliable measurements. Although civil aircraft remain below the sound barrier, they come close enough to it so that in actual operation local crossovers do occur. These details, too, which are important for the flow, can now be purposefully examined.

All this naturally drives costs sky-high. In order to operate as economically as possible, the ETW is constructed modularly. This allows the entire measuring assembly to be lifted out of the windtunnel with a crane if changes have to be made on it. In the meantime, another measuring assembly is brought in, so that the windtunnel does not have to stop operating. This is supposed to make possible three series of measurements per day.

According to Uso Walter, administration manager of ETW, "With the modular assembly we can even run measurement series for competing firms simultaneously," because the assemblies and the results can run both independently and screened from one another. The interest of Western European aviation companies was so great that they had already joined together in an "Industrial User Group." However, Walter believes that the ETW could be interesting for aircraft manufacturers in other parts of the world as well, such as the Soviet Union.

Even if the test series cost millions of DM—Walter could not give more precise figures—the companies will find the facility very useful. First of all, the American windtunnel, which is owned by NASA, is usually closed to foreign firms. Thus, if a lack of simulation opportunities means that changes to an already launched series production can be made only after the flights of prototypes, which has already happened in the past, then the costs are considerably higher.

Regular operation is supposed to begin in 4 years. Harris stresses that the project is both within its budget and on schedule for completion in December 1992. But it will surely take over a year to calibrate the instruments and devices.

GEC, Thomson To Develop EFA Radar System

90MI0247 Milan ITALIA OGGI in Italian
19-20 May 90 p 10

[Article by Alberto Toscano: "GEC and Thomson Together for the Radars of the Future"]

[Text] After having acquired Ferranti Defence Systems, the British company GEC-Marconi was assigned the task of producing a radar for the future European EFA [European Fighter Aircraft] superfighter, the result of a joint effort between the FRG, the UK, Italy, and Spain. At the same time, Thomson CSF has been working on a radar for the future French Rafale superfighter. A competitive situation has emerged which could have unpleasant consequences for the future of the European community's aerospace industry. GEC-Marconi and Thomson CSF, however, have decided to start looking beyond the day after tomorrow, by reaching a preliminary agreement for the preparation of a radar that might one day be used by the successors to the Rafale and EFA. In truth, the French still hope that the EFA will never see the light of day, given the opposition of the German Social Democrats. They hope that the new generation radar will be primarily the result of their research for the "homemade" Rafale superfighter.

In an interview with the Paris-based economic daily LES ECHOS, David Fletcher, number two at GEC-Marconi, stated that his group is at the point of reaching an agreement with Thomson CSF on the futuristic radar. This choice is destined to reduce, or even eliminate, the traditional competition between these two European military electronics groups. The agreement should be associated with that signed last July by Thomson CSF and Ferranti. The fact that Ferranti's radar activities are now in the hands of GEC-Marconi certainly favored GEC-Marconi's contacts with Thomson CSF.

According to Fletcher, "closer relations with Thomson" is "the best thing" that GEC-Marconi could do. However, GEC-Marconi would like to extend the agreement to the French group, Electronique Serge Dassault (which just changed its name to Dassault Electronique). GEC-Marconi is also collaborating with Dassault Electronique and with Matra in the production of the Mica missile intended for the Rafale. David Fletcher pointed out that competition in the military sector among the countries on the continent is bound to decrease because "the creation of a European industry in the arms sector is inevitable." The moral: "One must take advantage of all opportunities when they present themselves."

The position taken by GEC-Marconi and Thomson CSF, however, reflects the European market's alarm regarding the very expensive Rafale and EFA superfighters. The EFA project is behind schedule with respect to the French project, but having succeeded in overcoming the obstacle of British-German competition over the radar definitely constitutes a favorable result from the point of view of its promoters. The Rafale is further ahead, but is having difficulty because France is completely isolated in its development, and risks becoming its only buyer in the future.

FRG's Interim Budget for Columbus, Hermes, Ariane 5

90MI0235 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German
27 Apr 90 pp 2-3

[Text] Category 30 in the 1989 budget allocates a total of 770.5 million Deutsche marks [DM] for the FRG's contribution to the ESA [European Space Agency]. The government draft for 1990 provides for DM891.6 million, an increase of 15.7 percent over 1989. These figures include DM379.6 million in 1989 and DM485.7 million in 1990 for the Columbus, Hermes, and Ariane 5 development programs; these programs are thus fully covered.

The development programs had started up more slowly than anticipated in the program announcements made at the end of 1987, State Secretary Dr. Ziller from the BMFT [FRG Ministry of Research and Technology] stated in answer to a parliamentary question. "This program had to be launched cautiously because we needed to ensure the closest possible coordination with the NASA and Hermes programs in particular, in order to reduce the risk of program changes and thus limit the element of risk in the costs," he said.

As he had stated elsewhere, Columbus and Hermes had already embarked on their initial phases, which would also serve as a basis for more precise cost figures. In accordance with the resolution passed by the ESA council of ministers in the Hague on 9-10 November 1987 and the agreements on the programs, the decision to pass from Phase 1 to Phase 2 in Hermes and Columbus will only be made at the end of 1990 or the beginning of 1991.

During the debate on the government's draft budget for 1990, the federal minister of research and technology stated that entries for the ESA contribution in the new financial plan for category 30 as of 1991 did not yet fully cover the FRG shares in the three future Ariane, Columbus, and Hermes projects, and that allocations in line with ESA contribution requirements would have to be ensured when budgeting was resumed the following and subsequent years. Should it then emerge that the resources allocated under the financial plan for ESA, and in particular its major Ariane, Columbus, and Hermes projects, still fail to cover the actual financial requirements, the allocations would have to be renegotiated.

The following FRG contributions to ESA are scheduled over the new financial planning period:

1990	1991	1992	1993
891.6	932.6	996.1	1,079.35 (DM million)

Italy: Aermacchi's Water Tunnel, Flight Simulator Described

90MI0208 Rome AIR PRESS in Italian 2 May 90 pp 1005-1007

[Text] A water tunnel and project simulator: Two elements that could be defined as Aermacchi's "advanced research section" are being used more extensively at the company for both internal purposes and for third parties. This fact emerged from a recent visit to the Venegono plant where the company's current situation and future prospects were examined.

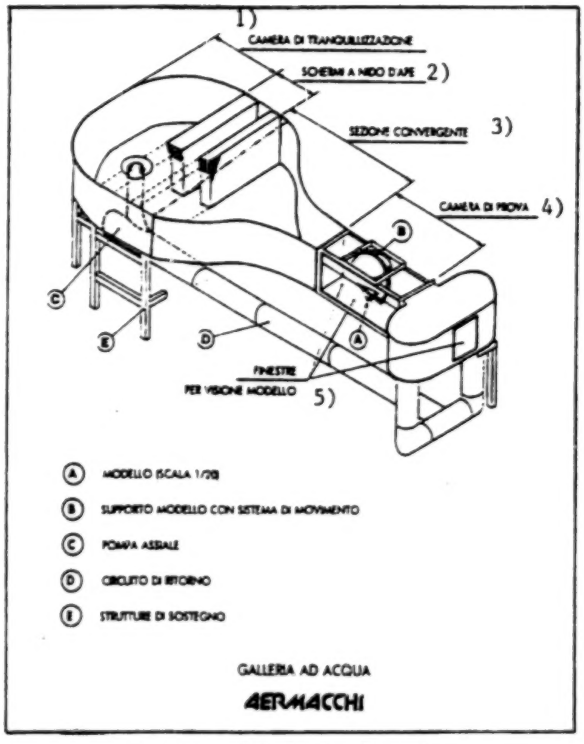
Water Tunnel

Using water as a means to visualize the vortical movement of the sea and its effects on ships is a concept that has been known since the time of Aristotle. It was even referred to in Reynolds' studies on duct flows and in studies carried out by Prandtl and Tietjens on the movement of contours. In recent times, wind tunnels have been used for aerodynamic studies on aircraft and other objects, and consequently the use of water for project simulations was abandoned. Interest has flared up again with the advent of the latest generations of transport and fighter aircraft, where there is always a tendency to achieve greater improvements. It is therefore necessary to study the possible effects for positions that are different, or in a certain sense anomalous with respect to the normal flight envelopes [inviluppi di volo] that can be analyzed in wind tunnels.

According to an Aermacchi report: "Until some years ago, the maximum working life of a wing or profile was determined by the onset of separations or vortices. Given the new design of aircraft, we want to actively use this possibility of generating organized vortical systems instead."

In this way the design of an aircraft's surfaces can be influenced by extending the area of control well beyond the stall, which has always been considered the limit of the flight envelope. "This results in aircraft capable of operating at extremely high angles, greater than 45 degrees, with a subsequent increase in maneuverability and without negatively influencing their conventional features." The water tunnel is put to full use when defining the best flight configuration at high attack angles since it displays all the vortical systems.

Aermacchi has had the Venegono water tunnel since 1989. The tunnel's function is to obtain displays of complex flows on scale models at extremely low costs. This is achieved by continuous monitoring with telecameras and video recorders, which give the visual sensation of what is happening. Small spurts of different colored liquids squirt out from special apertures in the model to mix with the surrounding water and visibly display how vortical or nonvortical flows develop.



Aermacchi's Water Tunnel

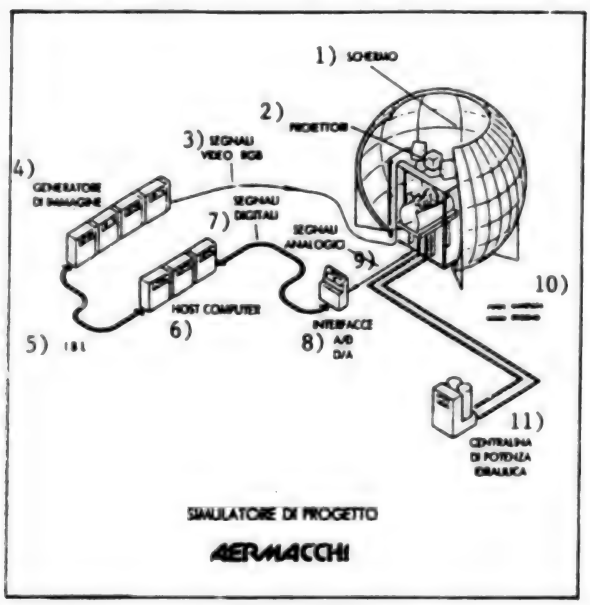
Key: (1) Settling chamber (2) Honeycomb screens (3) Converging section (4) Testing chamber (5) Windows for model observation (A) Model (scale 1:20) (B) Model support with movement system (C) Axial pump (D) Return circuit (E) Supporting structures

By using this device (the only one of its kind in Europe), Aermacchi has already been able to compare the results obtained in the wind tunnel with the water tunnel's "visible" results. In the future, it will be possible to better integrate the two pieces of equipment and test special situations that otherwise would be difficult to control on models or at the prototype stage. "In conclusion," the Aermacchi report stated, "the water tunnel is another instrument for achieving a better understanding of the phenomena that will be studied in the wind tunnel."

Project Simulator

According to a company statement: "In the last three years, Aermacchi has been deeply involved in the design, development, acquisition, and integration of a flight simulator and so-called human engineering. The result of this effort is a project simulator, composed of a few main subsystems, that is in the high bracket of existing industrial products."

The aircraft and subsystems are schematized according to special mathematical models and then translated into computer programs located in the host computer. These react to stimuli from the pilot seated at the simulator's control panel. The results of the simulations are converted to give the pilot "real" sensations of the flight and the possible effects of the various maneuvers. The computer's speed allows for reaction times that are extremely close to real behavior. A fundamental element of the simulator, however, according to Aermacchi, is the visual system, which gives the pilot the visual sensation of movement and not just resistance. Using a computer-generated image, the scene that the pilot sees is instantaneously reconstructed (through millions and millions of impulses) from the aircraft's altitude and flight attitude in that precise instant. For this reason, it is absolutely necessary to have instruments of this kind, as well as the commitment displayed by Italian industries involved in research, which is seen as a basic premise to the practical implementation of the projects.



Project Simulator

Key: (1) Screen (2) Projectors (3) RGB [red, green, blue] Video Signals (4) Image Generator (5) IBL (6) Host Computer (7) Digital Signals (8) A/D [analog-to-digital] interface, D/A [digital-to-analog] interface (9) Analog Signals (10) Transmitted, Return (11) Hydraulic Power Station

Italian Space Agency's Programs, Funding Reported

Scientific Programs

90MI0220A Rome SPAZIO INFORMAZIONI in Italian 9 May 90 pp 2-3

[Text] The Italian Space Agency's (ASI) scientific committee— in operation since October 1989 and chaired by Professor Remo Ruffini from the Physics Department of La Sapienza University in Rome—is currently defining the details of the first global economic plan for scientific programs, which is expected to be submitted to the ASI's board of directors on 15 June. The news was given at a recent meeting in Capri that was attended, among others, by Professor Roger Bonnet, Director of the European Space Agency's (ESA) scientific program. The various national scientific research projects of the ESA members were presented at the meeting. Italy was represented by Prof. Ruffini, who illustrated the activities of the ASI's scientific committee, reminding his audience that these activities will be able to count on "funds amounting to no less than 15 percent of the national space plan." Prof. Ruffini also pointed out that the request for funding in 1991 would be defined by the committee by the end of October. Submission to the ASI board of directors is scheduled for early January 1991.

ASI's Scientific Programs

In his interesting report presented at the Capri meeting, the chairman of the ASI's scientific committee described the details of several national and European scientific programs with Italian participation by dividing them into the following fields: 1) optical and ultraviolet astronomy; 2) X- and gamma-ray astrophysics; 3) infrared astronomy; 4) solar, terrestrial, and interplanetary physics; 5) planetary sciences; 6) basic physics of space. A complete list of these programs, including those already approved and those still under consideration, follows:

1) Optical and ultraviolet astronomy
   Approved: Hubble Space Telescope, IUS (International Ultraviolet Explorer), Hipparcos, Spectrum X-Gamma.
   Under consideration: ASTROS AT-PT (Astronomy Satellite on Platform Tethered), IEH (International EUV/FUV Hitchhiker), Prisma, Santa Maria, SUV (Spectrum Ultra Violet), TOMCAT (Telescope One Meter Class Attached), XMM (X-ray Multi Mirror).

2) X- and gamma-ray astrophysics
   Approved: SAX (satellite for astronomy X), Spectrum X-Gamma (experiments: JET-X, SXRP, MART-LIME), AXAF (Advanced X-ray Astrophysics Facility), LAPEX (Large Area Phoswich Experiment), GAMTEL (Gamma-ray Astronomy Telescope), FIGARO (French-Italian Gamma-Ray Observatory), Poker, X-Pallas.
   Under consideration: XMM (experiment: EPIC - European Photon Imaging Camera), Schmidtxray.

3) Infrared astronomy
   Approved: ISOCAM (Infrared Space Observatory Camera), TRIP (Infrared Cooled Telescope for Sounding Balloons), Argo, ISO (experiment: LWS).
   Under consideration: Sofia.

4) Solar, terrestrial, and interplanetary physics
   Approved: TSS-1 and TSS-2 (Tethered Satellite System), Interbol, Cluster, SOHO (Solar and Heliospheric Observatory) (experiment: UVCS), SVMFO (Solar Velocity

and Magnetic Field Observatory).
Under consideration: OSL (Orbiting Solar Laboratory).

5) Planetary sciences
Approved: Giotto, Mars 94 CRAF/Cassini.
Under consideration: Giotto-2, OPT (Orbiting Planetary Observatory), Rosetta/CNSR, Isabella.

6) Basic physics of space
Approved: Wizard & Astromag, Cassini, Ulysses.
Under consideration: IVS (International VLBI Satellite), Lageos-3, STEP (Satellite Task of the Equivalences Principle).

1989 Funding

90MI0220B Rome SPAZIO INFORMAZIONI in Italian 9 May 90 p 6

[Text] The Italian Space Agency (ASI) spent 739 billion lire for its activities in 1989, 323 billion of which were for national space programs and 416 billion were for participation in European Space Agency (ESA) projects. The programs funded by the ASI last year include the Italsat telecommunications satellite (183 billion), developed by Selenia Spazio, the Lageos-3 geodesy laser satellite (3 billion), manufactured by Aeritalia, the SAR-X synthetic aperture radar (21.5 billion), designed by Selenia Spazio, the SAX X-ray astronomy satellite (17.6 billion), developed by Aeritalia with the support of Telespazio, the TSS-1 satellite (29 billion plus 8.3 billion for the core equipment experiment), developed by Aeritalia, and the IRIS [Italian research interim stage] perigee engine (7.4 billion), manufactured by BPD and Aeritalia. Italian funding within the framework of the ESA involves, in addition to the mandatory scientific program and general budget, participation in projects such as the Columbus station, the Ariane-5 carrier rocket, the Hermes shuttle, and the DRS (data relay satellite) data communications system.

Italy: Aeritalia, Selenia Merger Announced

90MI0251 Milan ITALIA OGGI in Italian 17 May 90 p 18

[Article by Susanna Petruni: "Aeritalia and Selenia Merge. The Aeronautics Supergroup Is Born"]

[Text] IRI [Institute for the Reconstruction of Industry] has said "yes" to the merger between Aeritalia and Selenia. Consequently, the avionics, space, and defense electronics activities, that until now were divided between the two groups, will be rationalized and merged into a single Finmeccanica company. The director of the group will be a new section head whose name is not yet known. The technical formalities for the merger must also be defined. In this regard, Finmeccanica announced that "the boards of directors from the two companies will avail themselves of independent professional opinions for the economic and financial evaluations to support the operation." This operation is part of IRI's internal reorganization strategy announced by its president, Franco Nobili, some time ago.

The merger will generate a company that, at the end of the year, can count on a turnover of 5.5 trillion lire, 50 companies scattered throughout the world, and a work force of 30,000 employees. The new company will rank sixth in Europe after Deutsche Aerospace, British Aerospace, Thomson CSF, GEC, and Aerospatiale. Ferranti Italia's shareholding will also be included in the group. A strategy of greater autonomy and international expansion is envisioned for Elsag, the company involved in automation systems. To complete the operation, Finmeccanica will take over Selenia's controlling interest in Elsag. Entry into Piazza Affari [location of the Milan stock exchange] is also in the future of the new Finmeccanica group. IRI plans to make the share capital available to the public as well to allow the finance company directed by Fabiano Fabiani to expand its presence on the stock exchange. In this regard, it should also be remembered that quotations for Aeritalia stock have been suspended for the time being.

The second step, after this initial reorganization phase within the Finmeccanica group, could be the formation of a national aeronautics group. This group should combine all the activities currently divided among IRI, EFIM [Manufacturing Industry Holding and Financial Company], and Fiat. The proposal was made by a PSDI [Italian Social Democratic Party] representative on IRI's executive committee. In fact, Bruno Corti explained that now "this reopens the problem of creating a single national aeronautics group in which the principle industries operating in the sector can participate."

Italy: Fiat Group Increases Involvement in Space Programs

90MI0253 Rome AIR PRESS in Italian 9 May 90 p 1053

[Excerpt] Italian aerospace companies, and among these the Fiat group companies, hold important roles in the fields of propulsion and space systems, and as such will continue to participate in the major programs currently underway, particularly the Ariane program. This was affirmed by the president of Fiat Spazio, Giuseppe Grande, in an interview with LA LETTRE D'ARIANESPACE in May. "The group's commitment to space activities is shown by the recent establishment of Fiat Spazio which has the task of promoting the use of the high technology systems and products from these various companies," Grande pointed out, recalling that Fiat Spazio's shareholders are BPD Difesa, Fiat Avio, Gilardini, Comau, and Telettra, all controlled by the Turin-based firm. Grande described the group's activities in the space sector, starting with Fiat Avio (fixed and mobile wing engines), BPD Difesa e Spazio (solid or liquid propulsion systems), Gilardini (special containers for new propellers), Technospazio (automation and advanced robotics), and Telettra (a leading company in communications and earth-space transmission systems).

According to Fiat Spazio's president, BPD expanded its activity to solid propellants specifically for the Ariane program, and simultaneously became the first Italian shareholder in Arianespace with 4.6 percent of the capital. BPD will develop two solid propellant rockets for the Ariane 5, the stage separation engines, and eventually the satellite apogee engines. Accordingly, last November BPD and the French SEP [European Propulsion Society] of the Europropulsion company jointly signed a 810 billion lire contract with the French national center for space studies to develop and test the boosters. These boosters will be the largest solid-propellant engines ever produced in Europe.

Also for Ariane 5, Fiat Avio has designed and constructed one of the two liquid oxygen turbopumps that cause the oxygen to reach the combustion chamber. To date, added Grande, the three models (of 27 to be tested) already built according to established deadlines, have produced excellent results. Fiat Avio is the first Italian industrial firm to have worked on cryogenic propulsion engines. In the future, concluded Grande, it will develop launch systems for the intensive use of the European space station Columbus and for engines whose power will permit the transfer of heavy commercial loads into high orbit. [Passage omitted]

BIOTECHNOLOGY

EC Support for Transnational Programs for Protein Engineering

36980029A Groningen PROSPECTS IN PROTEIN ENGINEERING: ANNIVERSARY CONGRESS AT THE UNIVESITY OF GRONINGEN in English 14-18 Aug 89 pp 21-23

[Article by B. Nieuwenhuis, Commission of the European Communities, Directorate-General for Science, Research and Development, Directorate Biology, Division Biotechnology]

[Text] The Commission of the European Community is implementing several priority actions specifically designed for improving the competitiveness of European Biotechnology. One of these actions aims at the establishment of a Community network for training and research and has been executed, since 1982, in the framework of two successive Community programmes, the Biomolecular Engineering Programme (BEP) from April 1982 to March 1986, and the ongoing Biotechnology Action Programme (BAP; including its recent revision) for the period 1985-1989. BAP is to be followed by BRIDGE (Biotechnology Research for Innovation, Development and Growth in Europe) which will cover the period 1990-1993.[1]

BAP, the current programme, aims at:

- The establishment of a supportive infrastructure for biotechnology research in Europe.
- The elimination of bottlenecks which prevent the exploitation by industry and agriculture of the methodologies originating from modern biology.

To this effect, BAP contributes to the development of the most promising techniques in the field of enzyme and protein engineering, genetic engineering, cell culture technology and culture collections, bio-informatics, risk assessment and "in-vitro" pharmacological and toxicological screening.

In 1988 the Biotechnology Action Programme was re-examined and revised for allowing an increase of its resources. One of the objectives of this revision, with regard to the research action, was a strengthening of activities related to the biotechnology research infrastructure in the Community and, in particular, the use of information technology. The latter with particular emphasis on protein engineering and genome sequencing.

These activities are conducted at two different levels: research and training. For the research activities specific Community structures, called European Laboratories Without Walls,[2] are being created in the framework of BAP for organising transnational research in basic biotechnology and the transfer of technology from academic laboratories to industries. Methods, materials and results circulate freely within each ELWW and an important part of the work is implemented as a totally integrated joint effort. Thirty-six ELWW's have been constituted and launched in BAP and this number should considerably increase within BRIDGE.

A total of 126 projects are implemented in BAP which involve 416 laboratories. Seventeen of these projects deal with protein engineering and comprise 58 participating laboratories, which altogether receive a funding of 5.1 million ECU's (10 percent of the budget for research projects in the programme). A list of the project leaders involved and the proteins which are studied is given in Table 1. Information on the content of the projects can be found in the BAP Catalogue of Contracts.[3] Progress Reports are published annually[4] and can be obtained upon request.

Table 1. Proteins Studied in the Framework of the Biotechnology Action Programme (1985-1989) and Names of Project Leaders Responsible for the Research

Protein(s) studied	Project leaders involved
Antigen-antibody	Poljak (F), Winter (UK), Phillips (UK), Bricogne (F)
Synthetic vaccine design	Garnier (F), Robson (UK), Bomford (UK)
Protein structure prediction	Wodak (B), Claverie (F), Sander (D), Willems (B), Venken (B)

Thermophilic enzymes (Thermolysin and others)	Fontana (I), Jaenicke (D), Rico (E), Mateo Alarcon (E)
Penicillin acylase	Pain (UK), Schumacher (D), Bock (D), Guisan (E)
Ferritin, ROP	Arosio (I), Cesareni (I), Harrison (UK), Kokkinidis (GR)
Phospholipase A1 and A2, Staphylococcal lipases	De Haas (NL), Verger (F), Gotz (D)
Phospholipase A2	Berendsen (NL), Pickersgill (UK)
Elongation Factor Tu	Clark (DK), Bosch (NL), Parmeggiani (F)
Barnase	Wodak (B), Stanssens (B), Fersht (UK), Janin (F)
Alpha-amylase	Petersen (DK), Dodson (UK)
Alpha-amylase	Svensson (DK), Haser (F), Driguez (F), Lehmann (D), Marchis-Mouren (F)
DD-peptidases, Beta-lactamases	Ghuysen (B), Spratt (UK)
Rubredoxin, Ferrodeoxin hydrogenase	Moura (P), Cabral (P), Lespinat (F)
Ferredoxin $NADP^+$ reductase, Flavodoxin	Curti (I), Mayhew (IRL), Gomez-Moreno (E)
Asparatate carbamoyltransferase, Ornithine carbamoyltransferase	Glansdorff (B), Herve (F), Dideberg (B)
Methylamine dehydrogenase	Duine (NL), Hol (NL), Kruse (UK)

The groups involved have participated in the Annual Sectoral Meetings held in Capri, Italy, in 1987 and in Newcastle-upon-Tyne, United Kingdom, in 1988.[5] A final meeting is foreseen in Lisbon, Portugal, at the end of 1989.

These R&D activities on protein engineering are expected to continue and to expand in the framework of BRIDGE during the period 1990-1993.

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Developments in Protein Crystallography

36980029B Groningen PROSPECTS IN PROTEIN ENGINEERING: ANNIVERSARY CONGRESS AT THE UNIVERSITY OF GRONINGEN in English 14-18 Aug 89 pp 24-30

[Article by Wim G. J. Hol, BIOSON Research Institute, Department of Chemistry, University of Groningen]

[Text]

1. Introduction

Protein crystallography is presently changing in many different ways. One development is the explosion of interest in biomacromolecular structures by molecular biologists, immunologists, pharmacologists, synthetic chemists, theoretical chemists, and protein engineers. At the same time many technical aspects of protein crystallography are undergoing currently a rapid development. Some of them will be described in this contribution.

2. Crystallization

A prerequisite for obtaining high quality crystals of sufficiently large size is the availability of pure protein. In recent years, chromatographic techniques have made great advances allowing separation of mixtures of proteins exploiting differences in charge, size, hydrophobicity, affinity for column-bound small molecules as well as by interaction with column-bound large molecules such as immunoglobulins. Of course, traditional methods based on differences in solubility remain important in many purification procedures.

Protein crystallography can obtain in favourable circumstances spectacular results with less than 1 mg of protein material,[1] but more realistic amounts are in the order of 100 mg pure protein. Even then success is by no means guaranteed. Clearly, the growth of crystals of a particular protein is quite unpredictable. The subject is receiving much attention recently with mathematical procedures,[2]

zero-gravity conditions,[3] epitaxial growth,[4] studies of nucleation by light-scattering[5] and automatization[6-8] as examples. Much further research will be required, however, before the success rate of crystallization may be significantly increased.

3. Data Collection: Area Detectors and Synchrotron Sources

Once crystals are obtained, X-ray diffraction patterns have to be recorded. Here, spectacular advances are being made. After the computer-controlled diffractometer[9] and the oscillation film-method[10] of the 70's and early 80's, we are witnessing currently the advance of area detectors in virtually every protein crystallography laboratory.[11-14] On rotating anode generators these detectors imply an increase in speed of data collection by one to two orders of magnitude.

A tremendous impact is also made by the availability of synchrotron radiation, the intensity of which is enhanced by the use of multipole-wigglers and other devices.[15,16] For as yet unknown reasons, the effective life-time of many protein crystals is significantly enhanced when synchrotron beams, particularly with smaller wavelengths, are used.

Synchrotrons have brought back to life the technique of "Laue photography" where a broad wavelength range—say between 0.5 and 2.0 angstroms—is used instead of narrow band with a $\Delta\lambda/\lambda$-ratio in the order of 0.01. The power of this old technique is currently being actively explored for protein crystallographic studies.[17-19] One of the most crucial results of theoretical calculations is that with such a broad wavelength range the percentage of single wavelength spots is still as high as 80 percent.[20] Promising results have been obtained in studies on phosphorylase[19] and a quite promising X-ray picture of a protein taken with a total exposure time of a few nsec has been reported.[21] The accuracy and completeness of Laue data are being evaluated by several groups at present and, if sufficient, then a major step forward has been made towards a speed of data collection which was considered impossible even only a few years ago.

4. Phase Determination and Phase Extension

4.1 Isomorphous Replacement and Anomalous Differences

For de novo structure determinations the multiple isomorphous replacement procedure (MIR), often extended by anomalous dispersion information (MIRAS), remains virtually the only technique employed so far to overcome the central "phase problem" in crystallography.[22-27] Site-directed mutagenesis has been very useful by introducing cysteine residues in a molecule which, when interacting with mercury, gave well-defined heavy atom derivatives.

An entirely different approach is to determine phases only from anomalous dispersion information.[28,29] This is made possible by the tunable wavelength of synchrotrons in cases where the protein contains heavy atoms such as metals, but also selenium has proven to be useful [see e.g. references in 29]. The principle of this new method, called multi-wavelength anomalous diffraction (MAD), is to measure diffraction patterns at a number of carefully selected wavelengths chosen such that the anomalous differences are optimized.

Another development in recent years is the recognition of the power of phase extension by electron density averaging. It was already known for quite some time that the presence of multiple copies of the same protein subunit in the asymmetric unit of a crystal can dramatically improve the quality of an electron density map by averaging at constant resolution [see e.g. 30-32]. In the work on hemocyanin it appeared that density averaging could be employed very well for obtaining phases at higher resolution than originally known. The new phases are obtained by extension in very small resolution steps.[33,34] This can be understood by considering averaging procedures in reciprocal space.[35] Following the example of hemocyanin, this procedure for phase extension proved to be very useful e.g. in the structure determination of several large viruses.[36-38]

Even in the absence of multiple subunits per asymmetric unit, solvent flattening procedures have proven to be quite useful for phase improvement and even phase extension.[39] A most important part of this procedure is an automated determination of the enveloppe of the molecule. Originally this was a very time consuming step, but a reciprocal space procedure suggested by Leslie has made this considerably faster.[40]

4.2 Molecular Replacement

For cases where a structure of an analogous protein molecule is known the molecular replacement (MR) procedure is often applied very successfully. The separation of rotational and translation parameters[41-43] has proven to be very powerful and allows correct positioning of initial models in cases where only a surprisingly small fraction of the atoms is used in the starting model.[44] J. M. van der Laan and B. W. Dijkstra of the Groningen protein crystallography group were able to determine the orientation and position of the protease inhibitor eglin in a subtilisin:eglin complex. Eglin is a molecule of 7000 daltons for which the rotation and translation function could be solved separately while the entire complex had a molecular weight of similar to 35.000 daltons. It should be realised, however, that in such cases the starting model corresponds almost perfectly with the structure to be determined.

4.3 Combining Isomorphous and Molecular Replacement

When the homology between starting model and unknown structure drops below 30 percent sequence identity the molecular replacement procedure may not be successful any longer. In the case of Azotobacter vinelandii lipoamide dehydrogenase, which has similar

to 27 percent sequence identity with glutathione reductase, the starting model of glutathione reductase did allow the determination of the orientation but not of the position of the model structure. In this case, also the heavy atom derivatives were of very poor quality and did not permit tracing of the chain in the electron density map. However, by combining phase information from both isomorphous and molecular replacement procedures in the so-called "phased translation function"[45] the position of the glutathione reductase model could be established, and the lipoamide dehydrogenase structure solved.[46]

5. Structure Refinement

Refinement is a most important step of a structure determination because it provides accurate coordinates, information about mobility and knowledge of the position of solvent molecules. It used to be a time-consuming step—both as far as manpower and as computer time is concerned. Powerful computer graphics techniques[47] have speeded up the refinement process considerably, but also computationally major progress is being made. Over the years, interpretation of difference Fouriers[48,49] and cyclic real space refinement methods,[50,51] were followed by fast Fourier procedures alternated with regularisation steps.[52,53] Then "restrained refinement" became very popular indeed, in particular the program PROLSQ.[54] Recently, A. Brunger has introduced a new method, where procedures derived from molecular dynamics are used to explore large regions of conformation space while at the same time trying to minimize the difference between observed and calculated structure factors.[55,56] A similar procedure has been implemented by M. Fujinaga and P. Gros. It turns out that these procedures can correct surprisingly large errors in X-ray models.[57-59] This is really a most important development in quite a time consuming step of protein structure determination by X-ray crystallographic techniques.

6. Conclusion

Virtually every step in protein crystallography is undergoing rapid development at present. This is most fortunate because of the increasing interest in this discipline by such a wide variety of scientific disciplines.

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FRG: BMFT Funds Biological Security R&D

90MI0228 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 12 Apr 90 pp 3-4

[Text] The second phase of the "Biological Safety Research" subsidy program will concentrate on two main areas of the safety problems involved in genetic engineering:

- Further development of safety measures for the closed system, expecially for standardization and authorization purposes;
- Development of methods whereby the properties of the genetically engineered organism and its behavior in the ecosystem may be rapidly identified.

Around 40 million Deutsche marks [DM] have been set aside for the "Biological Safety Research" subsidy program for the 1990-1993 period. To date (1987-1989), subsidies amounting to approximately DM11 million have been granted for projects under this program. The study of safety aspects is, moreover, a fully integral part of basic and applied biotechnology research, which the BMFT [FRG Ministry of Research and Technology] is subsidizing this year at around DM270 million.

In 1987 the BMFT established the "Biological Safety Research" subsidy program, which has funded some 30 projects to date. The following projects have been initiated and sponsored under this program:

- A research and test center for open air experiments was established at the Federal Biological Establishment in Braunschweig. Research is carried out on biological safety, especially on plants, pathogenic plant and insect viruses, and microorganisms. The center consequently also acts in an advisory capacity as regards the granting of licenses to release genetically engineered organisms.
- Individual projects concern interspecies gene transfers, e.g., from a plant to another organism, which may be another species of plant or a microorganism. With higher organisms, such as plants, breeding has shown that horizontal gene transfer is extremely rare. However, there has been hardly any systematic research on this topic. There will now be a project to study the dissemination of a marker gene, implanted by genetic engineering methods, under simulated outdoor conditions in a secure greenhouse. Black mustard (brassica nigra) will be used as the genetically engineered plant; various other species of brassica (such as cabbage, rape, and turnip), as well as sunflowers, wheat, and rye will also be planted.
- Several projects are engaged on aspects of assessing the release of genetically engineered microorganisms into the environment. Studies of test ecosystems with various types of soil (clay, sandy) and various moisture contents, and the resulting computer models, should help make it possible to carry out general risk assessments and develop generally applicable assessment scales.
- Courses on safety in biotechnology will be held to provide professional teams engaged in biotechnology and licensing authority personnel with more specialized knowledge on which to base their assessment of safety-relevant issues.
- A high school textbook on microbiological and bacterial experiments is being prepared, so that experiments of this type may be carried out in safety. It is expected to be available by the end of 1991.
- The international exchange of scientific findings has been intensified with a view to achieving a uniform risk assessment as the basis for harmonizing genetic engineering safety regulations.

Genetically engineered organisms can be used in the environment in many areas (agriculture and forestry, food and foodstuffs, live-virus vaccines, waste and refuse disposal, extraction of raw materials), as is already the practice abroad, e.g., in agriculture and live-virus vaccination. The BMFT states that to date there have been 167 transgenic organism releases worldwide. Most of the experiments have taken place in the United States (76), followed by France with 28, Canada with 18, Belgium with 12, and Great Britain with eight releases. Most (112) of the releases were transgenic plants (including tobacco, tomatoes, soya beans, and potatoes). Genetically engineered bacteria and viruses were also released for use in the development of biological pesticides, animal vaccines, etc. The conditions and requirements for release are laid down by the national licensing authorities and include distance from other cultivated areas, manual cutting of the flowers, and manual harvesting. Not a single case of unintentional ecological change has been observed.

The Max Planck Institute of Breeding Research in Cologne has been given permission to carry out the first experimental release in the Federal Republic of Germany, using genetically engineered petunias; the release is scheduled to take place in May this year.

COMPUTERS

Cologne University To Install NEC SX-3

90AN0333 Edam SUPERCOMPUTER EUROPEAN WATCH in English May 90 p 3

[Text] The University of Cologne will install a NEC SX-3 in October/November this year. The machine will be a model 11, the smallest possible model with one Arithmetic Processor.

About the selection process, the head of the computer center, Wolfgang Trier, explained that benchmarking was done by extrapolating results from an SX-2 and a VP100/200, and "our problem was that we had no money to buy a system, we only had money for maintenance." So the machine is not sold but borrowed for a limited time.

We heard that the background for this decision was that North-Rhine-Westphalia wanted to diversify their supercomputer installations (Aachen-Siemens, Juelich-Cray, Bochum-CDC).

The university, says Trier, decided on the NEC machine, because the NEC Unix operating system, Super-Ux, was offered and the strategy for the future in Cologne is to migrate to Unix as much as possible.

This could be the very first SX-3 order worldwide. A machine might have just been sold earlier in Brazil, but this is certainly the first in Europe. Another sale for NEC is expected in the Netherlands at the aerospace lab NLR, a site which operates already an SX-2.

DEFENSE INDUSTRIES

European Military Satellite Project Envisaged

90MI0195 Rome SPAZIO INFORMAZIONI in Italian 4 Apr 90 pp 2-4

[Excerpts] European satellites managed by a European agency to monitor disarmament in Europe. This is the

goal of a recent symposium (entitled "Observation Satellites. A European Instrument to Control Disarmament Verification") organized in Rome by the Technology and Aerospace Commission of the West European Union (WEU) to evaluate the real prospects for any such initiative in view of the projects already underway within individual European countries. Leading figures from the political, military, and industrial world with an interest in examining the goals, means, and problems involved in the development of an entirely European satellite system attended the symposium. The system would be used essentially for the direct verification of arms control and disarmament agreements, but it would also be used to survey "hot areas" (such as the Middle East, the Persian Gulf, and North Africa) and to monitor ecological or natural disasters. This project (which, according to some estimates, would involve costs amounting to approximately $1.5 billion for the satellites and approximately $150 million per year for management activities) would be entrusted to an "ad hoc" European agency, the establishment of which was the topic of a recommendation submitted to the WEU Council. 'This recommendation," Mr. Charles Goerens, chairman of the WEU Council, stated at the symposium, "involves, on the one hand, developing a joint organizational program of measures designed to verify the implementation of conventional disarmament agreements in Europe and, on the other hand, carrying out a feasibility study on the establishment of a European agency for observation satellites." Dr. Bruno Stegagnini, chairman of the WEU's Technology and Aerospace Commission, emphasized that such a satellite system is "a necessary instrument, through which Europe can overcome its dependence on the superpowers' information systems. Europe," he concluded, "must be politically capable of managing an independent instrument to monitor disarmament verification, and technically capable of developing such an instrument."

Some European countries have already been involved in these operations for quite some time. France, in cooperation with Italy and Spain, is developing the two Helios military observation satellites, which are expected to be operational and in orbit in 1993 and 1995, respectively. At the Rome symposium, General G. Bousquet, Engine Director at the French Ministry of Defense, described what may turn into a plan for the development of a European system for monitoring disarmament via satellite. The first step would involve the establishment of an agency that would use telesurveying images, exploiting the data collected by the French Spot and the American Landsat satellites. Only in the second stage, Gen. Bousquet argued, could the go-ahead be given for the establishment of "a complete European satellite system to be developed and used within the framework of the agency." Finally, the third and last stage would involve expanding the system with an infrared and radar observation capability. This would ensure quicker access to information by improving the system's accuracy, regardless of the weather conditions prevailing in the areas under observation. [passage omitted]

The Position of the Italian Ministry of Defense

Italy's Defense Minister, the Honorable Mino Martinazzoli, was also present. Assessing the prospects for the development of an independent European capability in the field of military observation satellites, he recalled: "The French Helios program, developed jointly with Italy and Spain, represents the first concrete step in that it satisfies the domestic requirements of three member-states to have an independent capability." The eventual development of a program for the implementation of an evolutionary system open to cooperation with other European countries, the minister added, could be one of the possible solutions. However, an autonomous European satellite capability, which may be used to supplement the traditional on-site inspections envisaged by the monitoring system, raises the question of which agency should be responsible for the operations and results. The basic problem, therefore, Martinazzoli underlined, is not technical, but essentially political in nature, as it is closely related to the future architecture of European security. Supplementing the U.S. satellite system with an independent European satellite system could be considered unprofitable in purely economic terms if the North Atlantic alliance continues to be a general reference point for the European security system, even in the long run. However, it would become indispensable if West Europe and the WEU, which is the forum where security problems are discussed, were to assume more responsibilities and more effective roles. The problem is not a simple one that can be discussed within the WEU. Personally, the defense minister added, in principle I am in favor of establishing a parallel structure that would not be a complete alternative to the American one, which is consistently used by NATO. In particular, one must avoid the danger of separating two systems that should be oriented toward the same goal, namely monitoring disarmament treaties, predicting and managing political and military crises, and possibly providing assistance and control in ecological disasters.

"Italy," Martinazzoli emphasized, "has the technological and industrial potential to develop and manufacture a carrier rocket and reconnaissance satellites with the technical and operational features required to carry out surveillance missions such as those required by the CFE monitoring system or by the management of possible crises in the so-called outlying areas. Implementing such a project on an individual basis, however, would involve an unacceptable waste of resources. Consequently, European cooperation seems to be the only path, implying economic unification as well as political integration and in the future, integration of security as well. This involves the capability and will to develop autonomous satellite systems," the minister concluded, "thereby reducing dependence on external satellites as well as providing an effective and obvious contribution to support the common interests of western security."

What Will the European "Spy" Satellite Be Like?

An interesting study of the possible technical and operational features of the future European military satellite observation system was illustrated at the Rome symposium by Dr. Andrea Pucci, managing director of Selenia Spazio. First, Dr. Pucci revealed the system's technical and operational requirements: 1) detection of physical objectives (fixed and semifixed installations, maneuvers by military vehicles, naval and land vehicles, aircraft); 2) detection and cataloging of electromagnetic wave sources; 3) resolution in function of the targets, on the order of tens of meters for fixed and semifixed installations and one meter for vehicles; 4) all-weather and day/night detection; 5) frequency requirements (less than seven days with optimal programmed vision, less than six hours on demand and for specific targets including lateral vision); 6) data processing and handling (transferring the data to the analysis center: real time or, at the most, within 30 minutes; data analysis time: unprocessed, 2.5 hours, processed, four hours); 7) system and data protection; 8) additional requirements for system flexibility (use of available technologies, simple and modular satellite systems, fast and inexpensive launch systems).

"Consequently," Dr. Pucci stated, "if we consider the technical specifications on the one hand, and the technological developments and conditioning factors on the other, the most likely hypothesis is a multisensor system, based on a constellation of medium-type satellites positioned in low circular or slightly elliptic polar orbits. In view of special operational requirements, the system would be integrated with small satellites, specialized in particular orbits, with short operating lives and very low costs (expendable satellites). The system would be equipped with suitable protective devices for the telecommunications/telemetry/remote control systems, communicating with a network of ground stations, and possibly supported by a DRS (data relay satellite) system managed by a single data controlling and processing center. The latter would be suitably located and provided with data processing and manipulation systems that are capable of integrating the information transmitted by a number of satellites and sensors in virtually real time." "A program such as the one described," emphasized Selenia Spazio's managing director, "is certainly feasible with currently available technologies and those being developed. It is also true, however, that it is ambitious, complex, and costly. Like all programs of this type and degree of complexity, it calls for two other elements in addition to the indispensable political decisions and the availability of appropriate financial resources. These are a capable, competent, and efficient industrial system, and an agency responsible for managing the program that can understand, make decisions, govern, and plan. In my opinion," Dr. Pucci concluded, "this implies the establishment of a specialized agency within the WEU with a strong technical programming capability. This agency would be assigned the task of managing the program and the financial resources as well as managing the industries responsible for the development of the system."

European Fighter Aircraft Developments Reported

Radar Contract

90MI0256A Rome AIR PRESS in Italian 16 May 90 pp 1113

[Text] On 8 May, the governments of the FRG, Italy, the UK, and Spain announced their decision to develop the ECR-90 radar for the EFA (European Fighter Aircraft) proposed by the Euroradar consortium. The same day at 4:30 PM in Munich, Eurofighter Jagdflugzeug GmbH, the consortium responsible for the supervision of the EFA's development and production program which includes British Aerospace, MBB [Messerschmitt-Boelkow-Blohm], Aeritalia, and CASA [Construcciones Aeronautics S.A.], awarded the contract for the ECR-90's development to GEC Ferranti Defence Systems, the British Euroradar leader. Other Euroradar members are Telefunken Systemtechnik (FRG), Inisel (Spain), and Fiar (Italy). Of the contract's, total value of 850 million Deutsche marks [DM], approximately 120 billion lire are for Fiar.

The Euroradar consortium will produce the "pulse-Doppler" ECR-90 radar based exclusively on European technology. Fiar's role in the development of the radar involves participating in the system design and transmitter development. The transmitter is a component of major importance in achieving the extremely high performance required of a combat aircraft of the year 2000. Additional contracts are expected for the production phase of the EFA radar upon completion of the design and development stage.

Eurofighter Consortium

90MI0256B Rome AIR PRESS in Italian 16 May 90 pp 1114-5

[Text] The four firms (British Aerospace, MBB, Aeritalia, and CASA) that constitute Eurofighter Jagdflugzeug GmbH, the consortium that supervises the development and production of the European fighter aircraft, are completely satisfied. In a joint statement issued from Munich, Eurofighter and the four companies stated that they "support with satisfaction the governments' decision on equipment that is so essential for the new aircraft. The choice of the ECR-90 will guarantee that the requirements of the four nations are met and that Europe's technological capability in radar development and production is maintained. The EFA program," continues the statement, "has already been in the full development phase for two years and is proceeding according to planned schedules and costs to meet the date of entry into service. The four companies have prepared the basic equipment for production, while the principal structural elements of the first three prototypes

are already in the assembly phase. More than three-fourths of the equipment has been selected and most of the relevant contracts have been prepared."

The joint statement by Eurofighter and the four companies also says that "the defense of one's country and the support of defense alliances remain the principal objectives of the four countries. In the light of the continuing evolution of political developments and priorities, a fundamental requirement for every defense system is flexibility. Since the EFA's principal role is air defense, it must provide an effective defense capability and versatility that cannot be guaranteed by any other type of system (such as surface-to-air missiles). A highly operative capability with low management and support costs are the fundamental requirement of the EFA project. This ensures that its operational costs will be lower than those of any other equivalent aircraft in service."

"The EFA," concludes the statement, "is providing employment to thousands of highly qualified people from the aeronautical industry of the four associated nations. In addition, the program will make a fundamental contribution to technological progress and management capabilities which can later be applied to a wide range of civilian projects. This is bound to result in considerable economic benefits."

ONERA, Thomson Develop Synthetic Pulse Radar

90WS0044A Paris LE MONDE in French 15 May 90 pp 13, 15

[Article by J.P. Dufour: "Radar for the Wide Open Spaces"]

[Text]

Progress in Signal Processing Techniques Gives French Armed Forces Near-Perfect Radar

In appearance, it's quite harmless: about 50 steel towers arranged in two rows and some electrical wiring on the ground. It looks like a series of street-lamps, an incongruous sight in this plot of rocky ground at the Mediterranean testing center (CEM) on the Ile du Levant. In fact, it's the prototype for "synthetic pulse and antenna radar" (RIAS), a revolutionary apparatus developed by the ONERA (National Office for Aerospace Studies and Research), an agency of the Defense Ministry, in collaboration with Thomson.

It has nothing to do with conventional radar, whose rotating antennas emit a beam that is reflected and returns to the source when it meets with an object, a plane or a ship.

RIAS "uniformly lights up space," explains Gerard Garnier, assistant manager of the ONERA's "electronics and optronics systems." Each of the transmitter poles (twenty-five in the Ile du Levant prototype) sends its own signal in all directions. Then, using the waves received by the receiver poles, each point of the surveillance zone can be assigned a characteristics "signature."

This electromagnetic grid was made possible only by the impressive advancements achieved in recent years by computers specializing in "signal processing."

RIAS is based on the principle of the "electronic scanning" process, meaning in effect that the computer "imagines" the conventional radar beam through calculation. "In fact," says Garnier, "the computer explores every direction, makes assumptions on the possible presence of targets, and makes comparisons with what it receives." Which implies enormous computing power. Actually, although it was conceived and developed as early as 1975, the system was unable to function in real time until just last year. "In the early 80's, when we had just built the prototype," recalls ONERA "synthesis studies" manager Jacques Dorey, "one minute of aerial observation required a week of processing on a Cyber 360!" Since then, the ONERA has developed a parallel computer whose small size conceals a computing power of 3 GOPS (three giga—meaning 3 billion—operations per second). This represents approximately the equivalent of 30 CRAY X-MPs, the most powerful computers on the civilian market, but there is a size difference. The Cray is polyvalent, while the RIAS computer can perform only the task for which it was designed.

For the armed forces, RIAS approaches the ideal radar. It is practically invulnerable. The failure of a few of its many antennas (the future operational model may have about 100) has scarcely any effect on the unit's overall operation.

Because the computer can be kept under cover far from the transmitter and receiver poles, potential saboteurs would have even more trouble paralyzing the system.

RIAS permits simultaneous aerial monitoring and tracking, operations which would require two different types of apparatus using conventional radar. "In four dimensions, and soon in five: the three position coordinates plus speed and, later, acceleration", says Dorey.

As soon as targets are detected by the computer, they are permanently tracked. And since the "field of vision" remains at 360 degrees, it becomes possible to monitor an entire air combat in real time, a feat that was impossible with the conventional monitoring radar that takes about 10 seconds to complete one antenna rotation, enough time for a fighter flying at Mach 2 to cover 6 kilometers.

With conventional radar, a plane's on-board receiver receives radar waves and immediately informs the pilot that he has been detected. But with RIAS, it simply means that the plane has entered the surveillance area. There is no way to tell whether it's been detected.

In addition, using the "light" from the land antennas, a friendly plane that knows the characteristics and positions of the transmitter poles can detect an enemy

without emitting any signal, using a computer much smaller than the one on the ground.

Another size advantage is the long wave-length of RIAS transmissions, "well in excess of a meter" according to Dorey (the exact figure is a secret); it makes the absorbent coating of "stealth aircraft", which is invisible to the high frequencies of conventional radar, practically ineffectual. Lastly, this new breed of radar is very difficult to jam; in fact, the computer is capable of recognizing decoys. It then automatically adjusts by creating "holes" in the radar pattern, i.e., ignoring the zones where the jammers are located!

Is this marvel of military technology the only one in the world? "I have my doubts," confides Dorey. "It's hard for me to believe that the United States doesn't have an equivalent system." In any case, a NATO delegation will travel to the Ile du Levant next month to witness a demonstration of the RIAS prototype, an operational model of which is to be built by Thomson.

RIAS is a spectacular illustration of the extraordinary possibilities offered by the particular sector of computerization that specialists call "signal processing." A method which, as its name implies, consists of manipulating an enormous mass of "signals" from multiple sensors in the shortest possible time, and which can be applied not only to radar but also to the processing of images and sound (or ultrasound for echo-sounders, for example). This is just what our brain does using the information it receives from our sense organs.

Military officials, concerned with giving their missiles sophisticated "eyes" and "ears", gearing down pilot options, or monitoring the smallest suspicious movement on land, in the sky, on the surface, and under the deepest oceans, are obviously the most interested and the most advanced in this field. But civil applications are countless, from high-definition television to scanners. And the perspectives are dizzying. "In this field, the limits don't depend on chips or on hardware, but on computer architecture and algorithms" (mathematical programs), says Dorey. "For the time being," he notes, "we are up to about ten GOPS (10 billion operations per second), but we think we will go beyond TOPS (trillions of operations per second) by the end of the year in analog optical computing and, 10 or 20 years from now, in digital computing (more accurate, used in conventional computers)."

France Develops New Naval Combat Equipment

Nuclear Submarine Simulator

90WS0048A Paris L'USINE NOUVELLE/ TECHNOLOGIES in French May 90 p 17

[Article by Thierry Lucas: "Simulated Navy Combat Exercise"; first paragraph is L'USINE NOUVELLE/ TECHNOLOGIES introduction]

[Text] Saturne, the NCS simulator, combines faithful reproduction of operational conditions and computational power. It enables "Amethyste" submarine officers to prepare for their future jobs.

When the nuclear combat submarine (NCS) "Amethyste" is put into active service next November, its crew will already have considerable "tactical experience." Thanks to the Saturne simulator, now up and running at the Toulon School of Submarine Navigation, future crew members can begin training now on the tactical systems used by the submarine: detection (sonars), information processing, and firing of torpedoes and missiles. All with the utmost realism.

The look and sound of the central navigational and operational station is replicated, while the instructor pilots up to 16 ships, submarine or aircraft, in the neighborhood of the simulated NCS from his console. Each of them is in turn capable of activating its weapons and detection system.... Designed and constructed with DCN as chief contractor, and in close collaboration with Navy users, Saturne is the outcome of four years of development. Its design is based on two principles that had to be reconciled: faithful reproduction of operational conditions, in terms of real-time constraints, and the use of civilian computer equipment, less costly and more open-ended. The first criterion demanded computational power. The system has it: 100 Mips and 30 Mflops.

As for choice of computers, a well-chosen architecture makes the best use of what the market has to offer in standard equipment. A computer made by Gould, real-time specialist, is dedicated to control of moving objects. Next, each simulation station—sonar data collection, information processing (that is, calculation of the distances, routes and speeds of the ships located), firing of tactical weapons, navigation—is equipped with one or two computers. The latter are the Bull SPS7 (for console image control) and Cimsa-Sintra's Mitra 625. Built in module form, Saturne is going round out its panoply: Within two years, submarine students will be able to "play" with an electronic war (countermeasures) system and use a periscope that will spy...synthesized images.

Acoustic Signal Detection

90WS0048B Paris INDUSTRIES ET TECHNIQUES in French 18 May 90 p 23

[Article by Yves Ciantar: "Sound Trackers"; INDUSTRIES ET TECHNIQUES introduction is "Computer-assisted acoustics applied to submarine combat"]

[Text] The mechanic unplugs the microphone and turns to the computer: In a few seconds, the system has processed the sound and designated the defective part on the 3D display. Such a scene is still science fiction fantasy. But not for much longer. In Toulon, in a navy research center, two systems can boast such performances. The object of their attentions are submarine and ship engines.

The Navy laboratory developing these kinds of software programs is GERDSM (Submarine Detection Research and Study Group). In charge of spotting enemy vessels, the laboratory is equipping French nuclear submarines with the means of seeing without being seen. Which, underwater, means listening without being heard.

System Probes Spectral Lines

"It is the age-old dialectic of the shield and armor—underwater," observes Xavier Marchal, head of the center. Besides active detective devices, such as sonar, one of the major thrusts of research is passive detection, that is, ship acoustical signatures. Acoustical signatures are the sum of the noises emitted by a vessel: hydrodynamic noises resulting from movement through the water, the noise of the propulsion unit, the flow of liquids through pipes. From this signature, a man deduces the characteristics of enemy or friendly ships. This is the so-called "golden ear." He extracts information from the background noise in a few minutes, an arduous and exhausting task.

That is why it was decided to supply him with a computer-assisted reconnaissance system. The system probes spectral lines to recognize the type of propulsion a ship is using and automatically pulls up the diagram of the propulsion unit. It does this by drawing on a data bank integrating the different elements inventoried: engines, pumps, tubes. This approach is also found in another system used by the center, dubbed Ursula. It is being readied for manufacture and characterizes friendly ships. The software program uses a relational data bank to assign each line a point of origin in the ship. Shipyards employ this diagnosis to lessen the ship's acoustical noise by trying to minimize each of the lines.

Before this artificial intelligence can come into play, there is a sophisticated signal-processing system that must be fed. To that end, GERDSM is also investigating physical reception, transmission and noise-reduction devices. For transmission, it is working on low-frequency sonars (0.1 to 1 kHz). A joint endeavor with the Northern Electronics Institute involves modeling transmitters that boost the acoustical power radiated by the resonance of their frames. Another topic, the use of acoustical holography to characterize transducers, is under study.

But the future is in "active skin", a "very attractive approach" according to X. Marchal, and a concept the laboratory intends to explore. A material covering the entire submarine will act as a receiver and as absorbing material. Another promising sector is active control, which will be the subject of a research program in 1991. Employed in certain airports, it is based on sending an out-of-phase sound wave toward the noise source, resulting in attenuation.

FACTORY AUTOMATION, ROBOTICS

ESPRIT Robot Controller Described

90AN0295 Zellik TECHNIVISIE in Dutch 4 Apr 90 pp 1, 12

[Article: "EC Project Produces Industrial Spin-Offs"]

[Excerpts] Three years ago, the ESPRIT project SACODY [Dynamic-Control Simplified Structure] was launched. This EC-subsidized project is developing a controller for a high-performance robot with online dynamic compensation. This means that the robot's end effector executes exactly the operation which has been programmed, irrespective of possible deflections of the robot joints and the flexibility of articulations. The project is led by Bertin & Cie (France). The other participants are the Mechanics Department (Prof. H. Van Brussel) of the Catholic University of Louvain (Belgium), AEG (FRG), Kuka Roboter (FRG), and LMS (Belgium). The University of Dublin (Ireland) is a subcontractor.

Three years after the project was launched, two sensor-based devices developed by the Catholic University of Louvain to detect the motion of the robot's end effector were commercialized by Krypton Metrology. Krypton was established by Eng. Johan Van den Bossche, a researcher who developed these sensors during his doctorate studies and started his own metrology company about a year ago. In addition to these two sensors, the Catholic University of Louvain also developed a measuring unit to detect a robot arm's deflection. Errors caused by this deflection can thus be corrected in real time during the motion through a feedback procedure to the robot controller. [Passage omitted]

First Sensor Is Two-Dimensional

Initially, Van den Bossche developed a two-dimensional measuring system called Rodym. It is based on a 2D-digitizing chip and a measuring sensor mounted at the end of the robot arm. The chip is linked to a PC through an RS-232 or IEEE-488 interface. The robot's motion in an XY-plane is detected by the sensor and recorded by the digitizing chips so that it can be displayed in real time on a computer monitor. The sensor must remain within a distance of 15 mm from the digitizing chip.

This instrument visualizes the difference between the programmed and actual motion. In addition, it makes it possible to monitor overshooting, repeatability of motions, drift caused by warming-up, and other phenomena. This portable test set can also be used for robot evaluations according to the European ISO-standards or the American ACE-standards.

The advantages of this system are its high accuracy (50 microns), portability, low cost, and user-friendliness; a disadvantage, however, is that it operates only two-dimensionally.

Further Advances in French Robotics Seen

90WS0047B Paris L'USINE NOUVELLE in French 10 May 90 pp 74, 76

[Article by Christian Cathala: "How Can We Boost Robot Performance?"; first paragraph is L'USINE NOUVELLE introduction]

[Text] What makes a great robot? Its programming and intelligence, of course, but also the dozens of mechanical components that make it up.

They weld, pierce, transfer, assemble, paint, and wrap. Robots, over 7,000 strong in France, have moved imperceptibly from the ghetto of very large companies into the world of small ones. The third generation, robot systems with a hint of reasoning ability, owe a great deal to electronics and programming. But the mechanical performance of their components also plays a major role in their recent development.

Robotics, however, is far from being able to manufacture what it is humanly possible to make. Besides the sticky problems linked to their programming, robots cannot mimic the movements made possible by the 42 rotational axes of an arm, from shoulder to fingertips. The best models barely inch past 6 degrees of freedom. Indeed, by multiplying degrees of freedom, and thus of complexity, risks of error, and therefore of machine reliability (sic), are also amplified. By using electrical motors rather than hydraulic systems to command robot arms over the last few years, engineers have succeeded in shrinking the amount of play that accumulates throughout the whole mechanical system.

The National Testing Laboratory, which tests robots, is now seeing machines whose repeatability accuracy (ability to replicate a task) is measured in hundreds of millimeters instead of the one-quarter millimeters of five years ago. But the increasingly complex robots now on the market still suffer from mechanical problems. So much so that manufacturers are beginning to affix personalized identity sheets to the machines they deliver. It is up to manufacturers to integrate the robot, as well as they can, in keeping with its peculiarities.

To skirt the obstacle of mechanical play, others have gone back to the drawing board. Some solutions, for instance, consist of combining the motor operator and rotational axis itself in a single component. Unfortunately for the American company Adept and France's AEC, who are working on this approach, the advantage of eliminating transmission (and therefore play) is offset by an enormous difficulty in correctly measuring angular variations. The latter are crucial data for electronic command of the whole system.

Moreover, the whole thing is much easier when reduction and other kinds of gear are used between the arm's rotational axis and the motor. Attempts to boost the performance of these robots also means breaking them of their annoying habit of being highly sensitive to temperature. One of the reasons robots are almost never stopped during production is that it takes them 4 hours to warm up and become really operational. Though studies have shown it to be technically possible to use composite materials in place of aluminum, cost estimates quickly demonstrated the difficulty of industrializing those kinds of prototypes for now.

Rather than trying to increase the rigidity of their machines, robot technicians hope to step up the number of servo-systems using atmospheric sensors. An example: when a mechanic screws in a drain plug under a car without seeing what he is doing, he uses a manual strategy. He feels his way closer and closer to the bottom of the case and drain hole and gropingly screws in the screw. A robot is a priori incapable of doing likewise, but tomorrow he may be able to.

A small Toulouse company, Aico, has developed a semi-electronic, semi-mechanical system that can be installed on any robot. The device is able to interpret the efforts of the pincer carrying an object to be mounted. As soon as the pincer applies too much force, the system tries again. Currently being tested at Aerospatiale for the manufacture of missile heads (including insertion of the gyroscope), this mechanical wrist paves the way for even better performing systems.

At the Ile-de-France Integrated Robotics Center, researchers are working on the development of a three-fingered pincer. This not as ordinary as it sounds when the fingers are independently articulated. For, if you look closer, you see that all the movements of the hand can be executed by combining thumb, index, and middle finger. If majorettes can juggle their batons that way, robots will do the same with their tools.

And suppose the solution to all ills were to leave the human model and anthropomorphism behind? Some researchers are beginning to explore this path. One example is the parallel-arm robot, a sort of overgrown spider hooked to a ceiling (where the command system is located), each of whose legs is driven by a motor. The advantage of this technique is that it allows "head" accelerations of at least 10 g, five times faster than one-arm models. Most of all, however, it allows maximum integration of all the mechanical elements in one place, limiting transmission. The French DM Developpement Company plans to begin marketing its Delta robot. During the year, three hospitals are going to prove that it can also dispense care.

Renault's Automated Production Discussed

90WS0047A Paris L'USINE NOUVELLE in French 23 May 90 pp 60, 62

[Article by Alain-Gabriel Verdevoye: "220 Robots for Clio"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Renault made it a priority to invest 3.5 billion French francs in a thoroughgoing automation of its assembly lines. Objective: To make Clio a standard for performance in the small-cylinder category.

With its latest model, Renault has just taken a new step forward in manufacturing. Little Clio is coming into the world with a performance rating higher than the one the recent R 19 had when it was launched: 140 points (out of a total of 162) compared to 135, according to the manufacturer's calculations. The defects of each model are inventoried as it rolls off the line. And the new Renault is obviously outshining the Super 5, which it will eventually replace.

To achieve this, Renault spared no expense: 6.5 billion French francs were invested in the X57 project (Clio), 3.5 billion of it in production equipment. A pricetag that matches planned output rates: 2,850 vehicles a day (1,550 at Flins, 650 at Valladolid, in Spain, 500 at Haren, in Belgium, and 150 at Setubal, in Portugal). The company's objective is to make Clio a standard for performance in the small car category (Peugeot 205, Ford Fiesta, Fiat Uno...), a standard that will blur memories of the Super 5's botched finishing job and mediocre lifespan. However, warns Pierre Jocou, Renault's quality manager, "no special treatment has been given the Clio. It is just more advanced than the R19, but less so than the models that will follow."

Renault made thoroughgoing automation of Clio's assembly lines a priority. As a result, robot stock at Flins has jumped from 90 units in 1985 to 220 today, 200 of them for sheet rolling alone. The sheet rolling shop, prime beneficiary of the move to further automation, got the lion's share of the manufacturing investments: 800 million francs (450 million for body-stamping and 300 million for assembly). Totally flexible and 99-percent automated (82 percent in 1986), the Flins sheet-rolling mill should eventually operate with reliability of over 99 percent per robot (96 percent in 1986). This level is computed twice daily on bodies smashed for the purpose. This is done even though the time between placement of the first piece and the moment the car leaves the sheet rolling shop has plummeted from 10 hours for the Super 5 to two hours for the Clio.

To achieve this, "unheard of and particularly Draconian specification sheets were imposed" on production equipment manufacturers, stresses Michel Cafard. The latter is director of body works and sheet rolling at Renault Automation, which supplied two-thirds of the tool stock of the Flins sheet-rolling shop.

Tool precision tolerances dropped from millimeters to tenths of millimeters, forcing Renault Automation to rethink the resistance of its tools, in order to protect their precision for as long as the model is produced. Moreover, an inspection device was integrated into the production equipment itself, to enable quick response to "variation" in quality, without interrupting manufacture.

The management of Renault Automation's body and sheet-rolling plant spent 10 million francs on research and development last year (1.5 million in 1988) to design these new tools. In particular, Renault Automation supplied the large 150-meter-long "spine", equipped with four Preciflex machines (total cost: 90 million francs), that assembles Clio's different components (rear skirt, body sides, hood, etc.).

The Preciflex machines are composed of three tools, precisely placed in relation to each other, rather than independently of each other as was the case for the Super 5. Independent placement resulted in more approximate assembly. In addition, the Perceval measurement software program makes it possible to verify quality directly on the line, whereas before this was done manually, using standard parts.

Assembly Time Plummets

As an illustration of the automation of the sheet-rolling shop, only 32 spots are welded manually, out of a total of 2,868 (for the five doors).

Besides greater automation of stamping, a special effort was also made to streamline assembly. The shift to two assembly lines producing 60 vehicles an hour (instead of three lines producing 40 units an hour for the Super 5) has, moreover, encouraged automation of the assembly shop by making the necessary investments more profitable.

In a first for Renault, the automated mechanical section enables the engine, wheel and axle sets, gearbox, underbody pipework, muffler, and tank to be automatically mounted. A machine with eight programmed robot arms inserts 18 screws and 17 clips. Moreover, the dashboard, heater unit, and pedal assembly are now robot-mounted. Bonding of the hood and filling of the brake fluid are also automated. As a consequence, the number of physically arduous tasks has been limited to 5 percent of the total for Clio (11 percent for the Super 5). At the end of the line, the rolling bench is completed by new test benches, to inspect alignment of the front wheels, power supply, and adjustment of headlights.

The step up in quality on the Clio compared to the Super 5 was also made easier by simplifying manufacturing operations. Indeed, Clio has 20-percent fewer welded spots than its forerunner. The number of body parts fell from 170 (Super 5) to 119. The Super 5's 200 body types have been narrowed to 33 for Clio.

Greater ease in assembling the model, better organization of shop flows, and automation of the process have sent assembly time plummeting: it now takes only 18 hours (eventually 16) to build a Clio, against 22 hours for a Super 5.

For Renault, the stickler will be cutting assembly time while stepping up production-line speeds. As it happens, quality control has just authorized Flins to boost its output from 400 to 800 cars a day.

LASERS, SENSORS, OPTICS

Italy: Monocrystal Research Laboratory Established

90MI0255 Milan ITALIA OGGI in Italian
5 Jun 90 p 46

[Article by Michela Fontana: "Laboratory For Special Materials Inaugurated At The Bicocca Center"]

[Text] The study of "high technology" materials is one of the most important areas of research, with direct industrial applications in strategic fields such as electronics, telecommunications, and aerospace. Even the optical computers of the future and the devices necessary for the large-scale use of optical fibers will require developing new high-performance materials. The knowledge and improvement of materials processing techniques is therefore indispensable for the development of industry with a high technology content. To date this area of research has been quite neglected in Italy, at least at the institutional level.

One step forward in bringing our country up to international research levels was made with yesterday's inauguration of the Milan Research Consortium's monocrystal and special materials laboratory at the Bicocca technology center of Milan. The laboratory's scientific director is Sergio Pizzini, a solid-state physics and chemistry professor at the University of Milan.

"The goal of the research we will carry out," Pizzini stated, "is to develop new processes for the synthesis and characterization of materials in the electronics, optics, and electrooptics sectors." Pizzini continued: "The laboratory was established with the intention of creating know-how that can be used by companies. We therefore intend to carry out a service for advanced industry." The center will develop techniques for growing monocrystals and will study several materials in particular: Barium fluoride for applications in high energy physics in the interior of gamma ray detectors (research is carried out on behalf of INFN, the National Institute of Nuclear Physics); lithium niobate, with applications in photonics; bismuth germanide, a photorefractive material; and synthetic silica for applications in fiber optics.

According to Pizzini, the present is a particularly exciting time in the field of materials for electronics. "With the exit of the American producers from the market," Pizzini stated, "a process of duapolistic concentration in the field of silicon production is coming to a close with the German Veba group's MEMC and the Japanese Shinetsu, which control the world market. In addition, old and new materials are coming face to face on the market. One example will serve for all: A major project on the development of extremely high resolution flat screens was launched in Japan and will also be launched in Italy. The necessary control electronics will be developed in polycrystalline silicon, a material that until now had only aroused interest for its photovoltaic applications and passive applications in microelectronics."

Participating in the inauguration of the Milan research laboratory were the rector of the University of Milan, Paolo Mantegazza, the rector of the Milan Polytechnic, Emilio Massa, the director of the faculty of sciences, Marcello Fontanesi, and the president of the Milan Research Consortium, Giampiero Cantoni (who awarded prizes for the best degree theses to a group of students). The laboratory is the second Milan research center to be inaugurated at the Bicocca center. A sensor laboratory was opened last year, with the goal of promoting the development and transfer of new sensor technologies for industrial processes, security, and environmental control. A cellular spectroscopy laboratory will be operational by June 1990, and will develop innovative diagnostic equipment for organic tissues in cooperation with the university and Biorad.

The other operational centers at the technological center are: Cefriel, a center for research and training in software engineering, Datasat, for research in the sector of telematic technologies via satellite, Agon, for the experimentation in the field of music and acoustics, and the Environmental Institute, an initiative of Federchimica, Confidustria, and Assolombarda.

Fraunhofer Upgrades Micropump Technology

90AN0294 Rijswijk PT/AKTUEEL in Dutch
18 Apr 90 p 1

[Article: "Smallest Pump Represents Major Breakthrough in Microsystems Technology"]

[Text] The Fraunhofer Society for Solid Materials Technology (IFT) in Munich has developed a pump that can dose and pump the tiniest quantities of liquid mixtures with extreme accuracy. According to researchers, the new micropump outperforms present-generation micropumps by a factor of 1,000, in spite of its limited size. The electrohydrodynamic principle on which it is based represents a major step in the development of microsystems technology.

The micropump measures only 5 x 5 x 0.7 millimeters. According to researchers, the pump is surprisingly simple, reliable, and resistant to wear; it should be particularly useful in chemistry, medicine, optics, and robotics, where the accurate dosing and pumping of small quantities of liquids is of vital importance.

The pump consists of two interconnected silicon grids, through which the liquid is pumped. The pump, which contains no moving parts, is mounted on a substrate. The micropump's operation is based on the electrohydrodynamic principle: In a static electric field, liquids can be pumped through the grids with a very high degree of accuracy. When 40 to 700 volts are applied to the silicon grids, ions form in the liquid and are accelerated between the electrodes. These ions drag along the liquid molecules, thus generating a liquid flow through the grid. In this way, polar liquids such as propanol, acetone, and

freon can be pumped. The pump can handle 15 millimeters per minute, which is 1,000 times more than existing thermal and piezoelectric pumps.

Essential Breakthrough

According to specialists, liquid pumping technologies rank among the elementary modern technological processes. The fact that no appropriate pump was available at the time represented a challenge to the sensor team at the Fraunhofer Institute. During their research, the West Germans picked up a long-forgotten concept dating from the 1960's, the electrohydrodynamic principle. This principle was found to be insufficiently cost-effective for macropumps because of the high voltage levels required. However, miniaturization eliminated this problem, since micropumps require lower voltage.

The development of the pump is regarded as a vital achievement for the development of microsystems technology. Microsystems tecnnology is a new discipline that combines semiconductor technology with sensor technologies and micromechanics. The interaction of these subsystems results in a "microdevice" with specifications that cannot be achieved by traditional methods. It could lead to a self-operating microdevice in which micropumps are linked to sensors and microelectronics.

Until now, any further progress in microsystems technology had been stalled in the absence of a significant breakthrough in micromechanics.

The West German Ministry of Research has had such high expectations for microsystems technology in fields such as mechanics, chemistry, and robotics that it appropriated DM 400 million in early February for the development of a core microsystem technology. The goal is the development of a fully integrated microsystem on a single chip.

Philips Develops New Semiconductor Laser

90AN0302 Groot-Bijgaarden DE STANDAARD in Dutch 18 Apr 90 p 1

[Article: "Reliable Alternative For Helium-Neon Gas Laser"]

[Text] Eindhoven—Researchers from the Philips Physics Laboratory have succeeded in developing a ready-to-use semiconductor laser emitting the same pale red light as the frequently used helium-neon gas laser. The light emitted by semiconductor lasers usually has a color somewhere between dark red and invisible infrared.

Semiconductor laser applications include fiber-optic communications and CD players. The new laser is the first semiconductor laser to emit light that is clearly visible to the human eye. It uses exactly the same wavelength (633 nanometers) as helium-neon gas lasers, which are frequently used in laser printers and bar code readers.

Until now, this wavelength could not be used in operational semiconductor lasers because the material loss was too high. The Philips laboratory is the first to achieve loss reductions that make the production of a 633-nm laser possible.

The new semiconductor laser has the following advantages over helium-neon gas lasers: very small size—0.3 millimeters as opposed to 300 millimeters for the helium-neon gas laser; high reliability; and high yield—which means that an ordinary battery can supply enough power.

The light-emitting core of the new laser consists of a number of extremely thin films of a mixed gallium-indium-phosphor crystal. Through vapor-phase deposition, these films are deposited in a perfect crystal structure onto a gallium arsenide substrate.

The difference between the new laser and infrared-light-emitting semiconductor lasers lies in the thinness of these films: Each film is 10,000 times thinner than a human hair, or a little more than a few dozen atoms.

Since the new semiconductor lasers are manufactured using primarily well-known semiconductor technologies, mass-production should be feasible.

MICROELECTRONICS

Siemens Announces New Chip Production Techniques

Low Temperature Bonding

90P60055A East Berlin RADIO FERNSEHEN ELEKTRONIK in German Jul 90 p 468

[Summary] Siemens has developed an improved bonding technology whereby silicon power components can be bonded to substrates, at temperatures below 240 degrees Celsius. The process involves the following three steps:

— a layer of silver, manufactured from layers of Al-Ti-Pt and Ag-Ni in such a way as to be sinterable, is introduced between the silicon and molybdenum surface layers to be bonded;

— then, silver particles, with a diameter of around 10 microns and dispersed in a solvent, are deposited on the molybdenum. Upon being heated, the solvent evaporates and, finally

— the silicon chip is aligned upon the silver layer. After two minutes of sintering at around 240 degrees Celsius and at a pressure of around 4000 newtons per square centimeter, a Si-Ag-Mb sandwich structure is produced.

Preliminary study results indicate that the electrical stability of materials produced via low-temperature bonding, as well as other parameters, are wholly comparable to values attained using high-temperature processes. That the components produced using the new technology are not warped after cooling is deemed an advantage. In contrast to alloying processes, no silicon is used in diffusion bonding. Further steps in the manufacture of components are not disrupted. Using the new bonding technology, discrete components as well as integrated wafer structures can be bonded to a substrate.

Improved Lithography Process

90P60055B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Aug 90 p 10

[Summary] Because of its high resolution, electron beam lithography is an indispensable means for manufacturing masks and reticles for VLSI circuits with structures in the submicron range. Due to its high level of flexibility, this technique is also gaining steadily in importance for writing directly upon wafers for the development of new types of semiconductor components, reports Siemens AG, Munich/Berlin.

In practice, the high theoretical resolution of electron beam lithography is nonetheless limited by the "proximity effect". This arises from the scattering of electrons in the photoresist and substrate and causes adjacent areas to flow into one another, as does ink on paper. Rough edges and fused structures thus occur as undesirable results. Using very labor-intensive approximation techniques, the scattering behavior of the electrons can be predicted. According to Siemens, in practice, a resultant change in the structural geometry and electron beam intensity gives rise to arbitrarily small discrepancies between nominal and actual values.

The firm claims that it has now developed a computer program, called CAPROX, which permits the local correction of particularly sensitive areas of a circuit. The user is able to select the critical locations of the circuit layout for the proximity correction, directly on the screen or by name. The corrections are calculated once for each structure type and can be used over again. CAPROX also comes in a version in which the corrections are determined without user interaction.

Netherlands: Electron Microscopy Projects Noted

90AN0293 Rijswijk PT/AKTUEEL in Dutch 4 Apr 90 p 1

[Article: "Technical University of Delft Opens Center For High-Resolution Electron Microscopy"]

[Text] In late March, the Technical University (TU) of Delft inaugurated the Center for High-Resolution Electron Microscopy (HREM). It is the first center in the Netherlands that can analyze materials at the atomic level. Up to now, researchers have had to leave Holland to do this.

High-resolution electron microscopy is a technology that enables materials experts to study the atomic structure of solids. Appropriate electron microscopes have been available for some time now, but until last week Dutch researchers had to depend on foreign institutes, such as the University of Antwerp.

The new center, installed in the Laboratory for Materials Science in Delft, is equipped with two Philips electron microscopes with a resolution of 2.0 and 2.3 angstroms, respectively. The aim is to increase the resolution of the first electron microscope to approximately 1.7 angstroms within the next few years.

Earlier this year, the Delft laboratory embarked on research aimed at optimizing peripheral electron microscope equipment within the framework of the EC's Basic Research on Industrial Technologies for Europe (BRITE) program. Philips and the University of Tuebingen are also participating in this research project.

Together, the two microscopes cost 3.2 million guilders. In all, more than 5 million guilders have been invested in the center, including the center's furnishings and salaries for two scientists for a period of 5 years. The investment was financed through contributions from the Institute for Basic Materials Research (FOM), the Organization for Chemical Research in the Netherlands (SON), and the Ministries of Education and Science and of Economic Affairs. In addition, the supplier, Philips, has offered to give a discount.

Industry

The center is open to universities and corporate researchers. Industry has already expressed an interest in the new facilities in Delft. Reactions from such companies as Akzo, Billiton, DSM, Exxon, and Unilever point to significant participation by industry: Expectations are that the electron microscopes will be used about 25 percent of the time by researchers from companies and from other universities.

High-resolution electron microsopes are important to various types of research. The Laboratory for Materials Science will use the new microscopes to study such things as grain boundaries, defects and phase transformations in metals, multilayer systems, and superconductors. The Center for Submicron Technology of the TU Delft will use the microscopes for silicon technology research (chip manufacture); the State University of Leiden for research on catalysers, high-temperature superconductors, metal clusters, and oxides; and the State University of Utrecht for research on catalysers and geology. Finally, in association with the Catholic University of Nijmegen, research will also be carried out on materials to improve solar panels and to make solar cells more efficient.

SCIENCE & TECHNOLOGY POLICY

Research Ministers Announce 91 New EUREKA Projects

Rome Conference

90AN0329A Brussels EUROPE in English 2 Jun 90 p 12

[Report: "EUREKA Ministerial Conference: Participation of Eastern European Countries, HDTV, Programme of the New Presidency"]

[Text] Rome, 1 June (EU)—The research ministers of the 19 European countries belonging to EUREKA [European Research Coordination Agency] (the Twelve, the EFTA Six, and Turkey) concluded their 8th conference today with the adoption of 91 new EUREKA projects. The "19" and European Commission Vice-President Mr. Pandolfi also debated relations with third countries, in particular those from Eastern Europe; high-definition television; and the programme of the new Dutch Presidency (the Netherlands is taking over from Italy). The next EUREKA ministerial conference will be held in The Hague in June 1991.

Relations With Third Countries

The "19" noted that political and economic changes in Eastern Europe will make scientific cooperation easier. They therefore firmly supported the idea of taking advantage of the flexibility of EUREKA regulations to encourage closer collaboration. Third countries already take part in 20 EUREKA projects, 12 of which involve Eastern European countries. The ministers and the Commission vice-president also noted that EUREKA can provide technological solutions to the problems of developing countries.

High-Definition Television

The EU HDTV 95 project is now entering its second phase. Production and broadcasting standards have been defined. The countries of the HDTV consortium invited the Dutch Presidency to report on the progress achieved and, if needed, to prepare additional proposals to be debated in The Hague in June 1991.

Programme of the Dutch Presidency

The Dutch minister announced an assessment of the EUREKA initiative in order to discover "new inventions". New attention will be given to the structural monitoring of the projects and of the progress achieved. An independent assessment panel will be established and its conclusions will be submitted to the 9th ministerial meeting.

Results of the Italian Presidency

In addition to the essential tasks—i.e., the continuation of the research underway and the approval of 91 new projects—the Italian Presidency reported on its other initiatives: reorganisation of the database, directory of EUREKA technological resources, seminars organised (including one in Florence on the use of advanced technologies by developing countries), parliamentary meeting aimed at making political circles more aware of EUREKA's action (a multinational "parliamentary club" was established to that end), etc.

As regards the EEC, Mr. Pandolfi announced that the European Commission is preparing two reports for the Council, the first one on relations between the EEC and third countries in the area of technology, and the other on relations with the Eastern European countries in particular.

Details of New Projects

90AN0329B Brussels EUROPE in English 1 Jun 90 p 14

[Report: "Research—91 New EUREKA Projects: Eighth Ministerial Conference"]

[Excerpt] [passage omitted on conference agenda] Out of the 91 projects chosen, 37 concern the environment (for total expenditure estimated at ECU 253 million); the environment is followed by robotics, with 22 projects (estimated cost of ECU 264 million), then biotechnology (9 projects, ECU 48 million), data processing and information technology (9 projects, ECU 96 million), new materials (5 projects, ECU 36 million), transport (4 projects, ECU 191 million), communications (3 projects, ECU 47 million), and energy (2 projects, ECU 27 million). Italy will participate in 40 of the 91 new projects. It is followed by France and the FRG (participation in 26 projects each), Spain (21 projects), Sweden (20), Norway (17), Austria (15), the Netherlands (14), Finland (13), the United Kingdom (13), Switzerland (12), Denmark (7), Belgium (3), Greece and Ireland (2 each), Turkey, Luxembourg, and Portugal (1 each); the European Commission will also participate in one project. Including the 91 new projects, a total of 386 projects will be carried out in the context of EUREKA. France is the principal participant (163 projects), followed by Italy (132) and Germany (129).

British Projects Detailed

90AN0329C Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 11 Jun 90 pp 1, 3

[Text] On June 1, officials of EUREKA, the pan-European R&D initiative in advanced technology, announced that a further 91 additional projects would be added to its list, bringing the total to 388. The new projects are worth ECU 964 million in investment terms and bring the total value of the programme to ECU 7,800 million, with investment split between governments (30 percent) and private enterprises (70 percent).

From a UK perspective, a total of 20 UK organisations will be involved in 13 of the new projects, ranging from

telecommunications manufacture to environmental projects under the "Eurocnviron" umbrella project. A total of 186 UK companies/organisations are now involved in 95 EUREKA projects with the UK having lead in 28 of these.

Of the new projects, Italy is participating in 40, West Germany in 36, and France in 26.

GPT is one of the UK companies involved in a new project and will partner Applications Techniques Electroniques Avancees (ATEA) of France in a 4.2 million pounds project to develop components for new wideband digital telephones.

Project EU250-CODIFEC will lead to the development of a system to upgrade present telephone audio quality to a bandwidth level comparable to that of a compact disc.

The new wideband audio codec will have significant applications in ISDNs, UK Industry Minister Douglas Hogg said at the announcements in Rome. GPT will draw on its experience in developing videoconferencing systems. ATEA will conduct development work at its laboratories in Fontenay-aux-Roses, near Paris, while GPT's efforts will be spread between GPT Data Systems in Maidenhead and GPT Mobile Systems and Terminals in Nottingham.

GEC Sensors, a subsidiary of GEC, will be lead organisation in a 29 million pounds project to conduct research into a terrestrial flight telephone system for public use in aircraft (project number EU443-TFTS).

EC Selects 107 New ESPRIT Projects

90AN0325 Brussels EUROPE in English 22 May 90 p 11

[Report: "New ESPRIT Projects: Participation of All Member States Increased Presence of SMEs—Repartition in Leading Sectors"]

[Text] Brussels, 22 May 1990 (EU)—One hundred and seven new projects have been selected by the Commission for launching within the European Strategic Programme for Research and Development in Information Technology (ESPRIT). This is the result of a thorough evaluation by over 200 independent experts of the 450 submissions entered during ESPRIT's latest general call for proposals.

Negotiations are now starting with the companies, research institutes and universities involved, with the objective that work can start on most projects before the summer recess. Most of the projects are scheduled to be completed in three years or less, showing the dynamic European response to the accelerated pace of the international technology race. The total cost of the projects likely to result is about ECU 690 million, half of which will be financed by the European Committees.

Participation by small and medium-sized enterprises (SMEs) has intensified, both in number and in the amount of R&D work done; more than one-third of all the work in the projects will be carried out by SMEs.

In addition to the 107 new projects, 43 exploratory actions, comprising workshops, demonstrations, and studies will be initiated, to further increase the involvement of SMEs in the ESPRIT programme.

As expected, there is strong participation from everywhere in the Community: Industries, universities, and research institutes from all Member States have joined in the consortia making the original 450 proposals entered during the call. The growing response to ESPRIT confirms that the European Information Technology (IT) sector is facing up to the challenge of international competition.

According to sector and project category, three projects form part of the 18th-month start-up phase of JESSI (Joint European Submicron Silicon Initiative). JESSI is a EUREKA initiative designed to strengthen Europe's international competitiveness in the design, manufacture, and application of a new generation of standard and customised microchips.

Aside from the JESSI projects, 40 percent of the selected projects concern the area of information processing systems (IPS), 33 percent computer-integrated manufacturing (CIM), and 27 percent office and business systems (OBS).

Independent Review Confirms ESPRIT Is Successful and Well-Run

As a result of the response to this call, all the work foreseen in ESPRIT's second phase will now have been launched. Overall, some 6,000 engineers, scientists, and researchers will be working full time on ESPRIT projects, once this new wave is launched. In addition, the Basic Research Actions started in 1989 established a strong network of leading academics and scientists, including several Nobel Prize winners. They are now working throughout Europe on key topics related to ESPRIT's goals on the theoretical level and have already made significant progress in different areas.

Since the beginning of ESPRIT, almost 500 projects and actions have now been launched, including those of the latest call. At the end of 1989, 163 of these had generated 320 major results, of which 129 helped to put specific products or services on the market, 36 enabled substantial progress towards internationally recognized standards, and 155 (mainly software methods and tools) have been put to use by participating organisations.

ESPRIT is well on the way to reaching its three objectives: to provide the European IT industry with the basic technologies to meet the competitive requirements of the 1990's, to promote European industrial cooperation in IT, and to pave the way for standards. The programme started in 1984. The total cost to date of ESPRIT amounts to ECU 4.7 billion, 50 percent of which was

borne by the Community budget, and the rest by participants in the projects. Each project consortium contains at least two independent industrial partners from different Member States in order to assure the application of the results of R&D efforts.

A comprehensive independent review of the ESPRIT programme recently concluded that, in the vast majority of projects, trans-European cooperation has been a success. It has resulted in significant benefits both for the participants and for Europe's technological base. Technologies, facilities, and human resources have all been improved and significant successes achieved on international standards. Links between industry and universities have been strengthened, managerial awareness of the strategic importance of IT heightened, and confidence and optimism about the future increased.

EC Approves Italian Role in EUREKA Projects

90AN0331 Brussels EUROPE in English 7 Jun 90 p 12

[Report: "State Aid/Italy/Research/EUREKA: European Commission Approves Aid in Favour of Italian Participation in Two Projects Concerning Constructional Steel Work and HDTV Digital Transmission"]

[Text] Brussels, 6 June (EU)—The European Commission has decided to approve aid to finance the cost of Italian participation in a EUREKA [European Research Coordination Agency] project intended to proceed to the definition, applied research, and subsequent evaluation for a modular computer-integrated manufacturing (CIM) system built around a project modeller for general steel structures such as multi-storey buildings, low-rise buildings, bridges, chimneys, masts, towers, offshore structures, cranes, etc. The Commission has taken note that the present project will facilitate the use and acceptance of the Commission's Eurocode 3 for the efficient application of Council Directive 71/305 and that it will help to ensure the commercial viability of the European constructional steel industry in the face of international competition.

Italy's share of the project amounts to 5,502.07 million lire (about ECU 3.3 million). A maximum aid of 1,712.5 million lire will be awarded to Italsiel SpA and Sidercad under the form of a grant for an aid intensity of 34.2 percent. The project covers basic and applied research.

The European Commission also decided to approve aid toward the cost of Italian participation in a EUREKA project intended to define an algorithm and codec structure for bit-rate reduction for HDTV transmission in contribution links and the implementation of codec prototypes. The Commission has taken note that the present project is linked to the activities carried out in the framework of RACE [Research and Development in Advanced Communication Technologies in Europe] and is complementary to the EUREKA project for HDTV production standard definition.

The Italian share of the project amounts to 8,836 million lire (about ECU 5.9 million). A maximum aid of 2,167 million lire for Telettra SpA and of 1,162.5 million lire for Radio Televisione Italiana (RAI) will be awarded under the form of a grant for an aid intensity of, respectively, 37.8 percent and 37.4 percent. The project covers both basic and applied research.

FRG-GDR: Joint Programs, Funding Discussed

Economic Infrastructure

90MI0229A Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 12 Apr 90 pp 5-6

[Text] The Federal Minister of Trade and Industry, Dr. Helmut Haussmann, has identified the establishment of a modern, functional infrastructure for the economic development of the GDR as a priority area for federal government aid. In this connection he referred to a subsidy program drawn up by the Federal Ministry of Trade and Industry. It will provide support for undertakings such as the development of industrial and trading areas, investment for small-scale road and telecommunications links, the creation of supply and waste disposal systems, and the establishment of training and further education centers for firms in the GDR. Federal funds amounting to 100 million Deutsche marks [DM] have been made available in 1990 and 1991 for this pilot program, which will initially be limited to the border regions. An equivalent amount is being provided by the FRG's border Lands. In preliminiary discussions, the GDR government has also expressed willingness to make funds of its own available for infrastructure development.

Joint ventures in the public domain between FRG and GDR institutions will be the point of departure for the concrete implementation of the program. The FRG partner will submit the applications for funding and assist the contractor in the GDR with organizing deliveries, placing orders, etc. There will be no need to build up a large bureaucracy, so the program can be implemented quickly and effectively.

Scientific Cooperation

90MI0229B Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 12 Apr 90 pp 5-6

[Text] Cooperation between the two Germanies on research, development, and technology is pressing ahead. This emerges from a preliminary report on the various Federal and Land initiatives that the Federal-Land Committee on Research and Technology drafted at its meeting in Stuttgart on 12-13 March 1990 and has since presented to the Land Economic Ministerial Conference. In addition to intra-German cooperation on technology policy, the committee, which reports to the Federal Ministry of the Economy, dealt primarily with

the development of joint industrial research and new subsidy measures in the FRG Laender.

At the federal level, the main issue is currently the expansion of science and technology cooperation (WTZ) with the GDR pursuant to the 1987 WTZ Agreement; this has given rise to 56 individual projects to date. In future, industry will be more closely involved in WTZ, with particular attention being paid to small and medium-sized businesses. Also at the federal level, there are various concrete ideas on how to improve technology transfer to the GDR, one being to assist in establishing a network of entrepreneur and technology centers. The Laender have also devised a series of activities, help for joint R&D projects between businesses and between research institutes and universities on both sides, and assistance in establishing a technology consultancy and transfer infrastructure. The Federal-Land Committee on Research and Technology will examine these issues in detail at a special meeting to be held in East Berlin at the end of May and to which experts from the GDR will also be invited.

Another important item on the Stuttgart agenda was joint industrial research. The committee first visited an establishment that has been very successful in joint industrial research—the Institute of Textile and Chemical Engineering in Denekendorf—and was informed about significant findings. The discussion then focused on the findings of two specialist reports from the Federal Ministry of Trade and Industry on the state of joint industrial research in the Federal Republic of Germany. The central issues were further expansion and increased efficiency. In this connection, the discussion centered on alternative ways of financing joint industrial research, increasing the involvement of small and medium-sized businesses in the development of research topics, improving technology transfer, and increasing the presence of new technologies in the range of joint industrial research topics. A high-ranking panel of experts will continue to examine the wide range of individual questions relating to the further development of joint industrial research, as recommended in the aforementioned reports. Another central item on the meeting's agenda was the detailed reports by the Land representatives on current research policy measures. More and more Laender are setting up technology policy advisory committees to advise the Land governments. The Laender continue to attach great importance to the establishment and expansion of new research institutes, for which a wide variety of legal forms are chosen (limited liability companies, foundations, etc.) and considerable public funds invested. Measures designed to improve technology transfer continue to play a major role in the repertory of Land subsidies. Land subsidies for innovation are increasingly including market launch phase costs. Some Laender are already considering whether their funding programs should subsidize joint ventures between local companies and GDR partners at preferential conditions.

Italy: New Chemical, Materials Research Programs Presented

90MI0245 Rome HIGH-TECH in Italian Mar 90 p 3

[Two "new" Italian National Research Programs, presented in tabular form and divided according to subproject and value]

[Text]

Two New National Research Programs

Chemical Program

Theme	Amount (billions of lire)
A) Chemistry for the Quality of Life	
Innovative methods and computing codes to design systems with high active and passive safety levels	7.5
Processes that use supercritical fluids and/or with safe raw materials	14.0
Chemical systems that protect against the effects of dangerous substances and ionizing radiation	9.3
Products for the use of clean technologies	13.5
*The development of membranes, membrane modules, and processes to rationalize production cycles	8.6
New technology for hide and leather tanning	9.0
Innovative integrated process for sugar production	13.9
*New products from algae biomass	9.0
B) Chemistry for the Building Sector and Building Infrastructures	
*Products and technology to preserve construction work	16.6
Products and advanced technology for the durability and improved quality of new construction work	17.0
*Products and technologies to reduce the effects of earthquakes on construction work with nonsuspended structures	9.7

Chemical Program (Continued)

Theme	Amount (billions of lire)
C) Chemistry to Preserve Cultural Assets	
Innovative diagnostic techniques to evaluate a material's state of preservation	7.1
Chemical technology and products to restore lithoid and metallic materials	6.6
*Chemical products and techniques to reinforce lithoid and metallic materials	5.9
Chemical methodology and products to restore and reinforce organic materials	9.1
*Chemical products and techniques to preserve lithoid and metallic materials	9.9
*Chemical methodology and products to preserve organic materials	9.9
Total	176.6

*reserved for southern Italy

Innovative Advanced Materials Program

Theme	Amount (billions of lire)
A) Structural Materials	
Polymer-matrix composite materials for aerospace applications	12.0
Development of polymer composite materials and components for civil and industrial use	8.6
Polymer-matrix composite materials and components for applications in the road transport industry	15.0
Development of applications for self-reinforcing polymer alloys	13.5
Development of coated metal laminates and the relative transformation technologies	12.0
Development of multifunctional glazing and complex geometry sheets for greater comfort	5.1
*Development of materials and innovative transformation processes for highly reliable products	39.0
B) Thermomechanical Materials	
Development of monolithic and ceramic composites for advanced energy technology	21.8
Development of monolithic or ceramic composites for mechanical technology	6.2
Development of metal-matrix composites for the aeronautical and space industry	12.7
Development of new products based on special metal alloysy and intermetallic composites for gas turbine components	11.9
Development of materials and technology related to advanced ceramic and metallic surfaces on metal tapes for various uses	7.8
Development of materials and technology related to advanced ceramic and metallic surfaces for anticorrosive and antiwear protection	6.2
*Technology for the disposal and/or salvaging of materials from widely used products. Development of packing and covering materials as an alternative to asbestos	39.0
C) Electromagnetic Materials	
Development of materials and technology for essential and innovative components to be used in optical fiber systems	10.2
Development of photosensitive material and related thin film technologies	4.5

Innovative Advanced Materials Program (Continued)

Theme	Amount (billions of lire)
Development of semiconductor composites for applications in high-speed electronics and photonics	25.6
Development of new technologies to produce semiconductor slices [fette di semicondutori] made of composite monocrystals	7.9
*InP material technology for optoelectronics	35.5
D) Superconductor Materials	
Development of materials and semimanufactured articles with a high-density current from ceramic superconductors, and refining production processes	5.4
Development of deposit and/or formation processes of superconductor layers for electronic devices, switches, or sensors	6.8
*Development of high-density current, semimanufactured articles for rods or cables in high temperature superconductors, and the development of methods for depositing high current layers on applicable forms	7.0
Development of high- or low-temperature superconductor materials for advanced magnets and cables with a high field and/or high degree of uniformity	6.0
E) Biocompatible Materials	
*New technologies for the preparation of biocompatible polymers with biodegradable or bioabsorbable characteristics	39.0
Naturally occurring biomaterials for the biomedical-health sector	11.0
*Creation of biodegradable materials that correspond to the disposal stage of the ecological system	38.5
Physical systems designed to permanently modify the surface properties of metals or polymers and their products, to make them biocompatible	7.8
Bioactive materials and bioabsorbable polymers	5.8
*Organic-matrix composites for applications with highly critical performance levels in the biomedical sector	20.0
Total	441.8

*reserved for southern Italy

SUPERCONDUCTIVITY

Italy: Industry Funds Expanded CNR Research Center

90MI0254 Milan ITALIA OGGI in Italian 26-27 May 90 p 45

[Text] Next year Italian superconductivity research will be able to count on an operative industrial arm in Lecco. The CNR's [National Research Council] Institute for the Technology of Nontraditional Metallic Materials (which has already transferred some activities from its original location in Cinisello Balsamo to the Milan Research Area in Via Bassini) will have a new, 4,000 square meter building, made to order by a group of businessmen from Lario who have invested more than 12 billion lire in the venture. Emilio Olzi, director of the [CNR's] Milan institute and head of the Materials Subproject within the Finalized Superconductivity Project can hardly contain his happiness. "This is a unique case in Italy. For the first time, the private sector has financed a National Research Council activity. The businessmen from the Lecco area have come to understand the importance that a research center targeted for the development of innovative metallic materials could also have for them."

Why such generosity? "Let us not forget that the opening of the European frontiers will require industrial production that is qualified to operate on the continental market. New materials are vehicles of technological innovation. For this reason, industry considers it useful to have a CNR laboratory at its disposal to which it can turn for its needs. We have been assured that the building will be ready in a few weeks. Orders for equipment valued at four or five billion lire are already being placed. At the beginning of 1991, therefore, we can begin." At Lecco, research on superconductivity will be carried out with traditional titanium and niobium alloys, which, among other things, are required to develop the superconducting magnets used in the accelerator rings of the large machines at CERN [European Organization for Nuclear Research]. "Magnets of this kind," explained Olzi, "require tons of the niobium and titanium alloy, which is currently a monopoly of the American company founded by a Japanese, Teledyne Wah Chang, of Albany, Oregon."

While waiting to use the new facilities in Lecco, Olzi's institute is in the forefront of the field of new superconductors. "We are primarily interested in bismuth oxides, which have produced the best results in the area of critical current. In collaboration with Pirelli and CISE [Center for Data, Studies, and Experimentation] of Milan, we developed bismuth-based cables that were easily able to carry 50,000 amperes per square cm in the presence of very intense magnetic fields, even at liquid helium temperatures of a few degrees above absolute zero. In these conditions it would be possible to build compound magnets with capabilities superior to those of traditional magnets: Placing the bismuth oxides inside, and the conventional superconductor magnet outside. However, in Milan we are also working with bismuth to increase the high-temperature critical current in liquid nitrogen. These experiments are currently underway, but I can say nothing more about them."

TELECOMMUNICATIONS R&D

Thomson, Philips To Cooperate in HDTV Research

90MI0248 Milan ITALIA OGGI in Italian 16 May 90 p 11

[Article by Alberto Toscano: "Thomson and Philips Join Forces in High Definition TV"]

[Text] Thomson and Philips have decided to join forces in the race toward high definition TV. The two companies reached an important agreement yesterday: "A great premiere," Roger Fauroux, the French industry minister declared emphatically. The French-Netherlands agreement was welcomed by the two governments and involves a five-year joint research program on high definition TV with 20 billion francs [Fr] (4.360 billion lire) in funding.

"High definition is our industrial future," stated Fauroux, "and the agreement between two groups that have been competing for decades represents the effort Europe needs to catch up with Japan." However, sources from the two companies directly involved in the far-reaching technological research project were much more reserved.

It was no news that the project was under discussion. However, doubts still remained about its rapid development and above all, the amount of funding. Instead, an announcement was made that a large amount will be allocated primarily by the Dutch group (Fr11 billion compared to Thomson's contribution of nine billion). The agreement, announced yesterday by Roger Fauroux, involves, among other things, a program for the development of integrated circuits and electronic components designed to capture images. Thomson and Philips will also carry out joint research in the field of recording and broadcasting equipment for new-generation television programs.

Within the framework of the EC, the French government is the most enthusiastic and determined to support industrial efforts aimed at high definition, which is considered a fundamental development stake. In a meeting with Chancellor Helmut Kohl at the Elysee Palace in Paris on 25 April, President Mitterand firmly emphasized the problem of the joint commitment toward high definition, primarily fearing that Bonn's business world is keeping its distance from Community programs.

On that occasion, Chancellor Kohl reassured Mitterand of the FRG's willingness to pursue joint research in the field of television. In the meantime, however, the French company has strengthened its contacts with the large Netherlands industrial group in view of the intensification of joint research. Paris fears that Japanese companies will compete with European companies on the EC market, and is skeptical of the research carried out over the last few years by other EC countries, Italy included.

Yesterday, speaking at a meeting organized by the Mediterranean Communications Institute, Roger Fauroux stated that Thomson's effort will be supported (to an unprecedented extent in the civilian industry sector) by public authorities as part of a specific contract.

The terms of the agreement between the French government and the publicly-owned Thomson group should be clarified over the next few weeks. Yesterday Fauroux declared: "It is very unusual for the Ministry of Finance to authorize a government commitment of this kind in an R&D agreement," but this exception is justified on the grounds that "high definition is an industrial priority for the French government." The joint research program between European industrial groups in new television technologies was launched within the framework of EUREKA [European Research Coordination Agency] and involved Fr2.5 billion (545 billion lire) in funding over the period 1986-90. This program has led to the development of a complete line of prototypes and the intermediate Mac Paquet standard.

According to a statement made by Fauroux yesterday, Fr3.5 billion (793 billion lire) will be allocated for the second stage of the European program (1990-92). All the terms of the agreement are expected to be finalized next month. Fauroux believes that "Europeans have only four or five years to achieve real high definition and thus catch up with the Japanese."

COMPUTERS

GDR: Floppy Disk Controller for K-1520 Microcomputer Described

90WS0039A East Berlin RADIO FERNSEHEN ELEKTRONIK in German Apr 90 pp 243-249

[Article by Michael Jakob, Manfred Urban, Andreas Pfeifer: "Floppy Disk Controller With DMA Control for K-1520 Systems"]

[Text] Microcomputer systems based on the U 880 still have their place even in the age of the 16-bit personal computer, particularly in the field of home computers. Therefore, in order to expand existing K-1520 systems, component group was developed that includes: a U 8272 Floppy Disk Controller able to handle a maximum of four 5.25-inch drives or two 8-inch drives with FM-MFM formatting; a DMA control with U 858 for the U 8272 Controller; two serial interfaces (one V.24 and one IFSS) with the IS U 858 and U 857; and a -12V transverter. This component group is described below.

In developing the floppy disk controller, we made sure, inter alia, to use components only from the RGW, only four of which are not produced in the GDR (75150, 75154 for V.24 interfaces, 7406 for floppy bus, and 75107 for the PLL). We also maintained full compatibility with the K-1520 bus system, so that the new floppy disk control could be easily integrated with existing systems. The master card measures 215 mm x 195 mm.

The floppy disk controller can also be used in 4-MHz systems if rapid components such as the IS UA 856, UA 857, UA 858, and U 8272 08 are used.

Description of the Overall Circuit

Figure 1 illustrates the block wiring diagram of the component group.

It consists of the five following function groups:

- bus control with address decoding and DMA control
- serial V.24 and IFSS interfaces with SIO and CTC
- U 8272 Floppy Disk Controller with clock and PLL
- motor control for floppy disks and the floppy disk interface
- -12V transverter.

The bus control provides the coupling to the K-1520 system bus and decodes the base address in the I-O field. By including the control systems of the system bus and the DMA-IS, this control can easily be accessed from the outside, i.e., the system processor, or from the inside for the DMA operations and the interrupt vector interchange of the I-O modules.

Serial input and output is carried out with a V.24 and an IFSS interface. An SIO U 856 is used to serialize data,

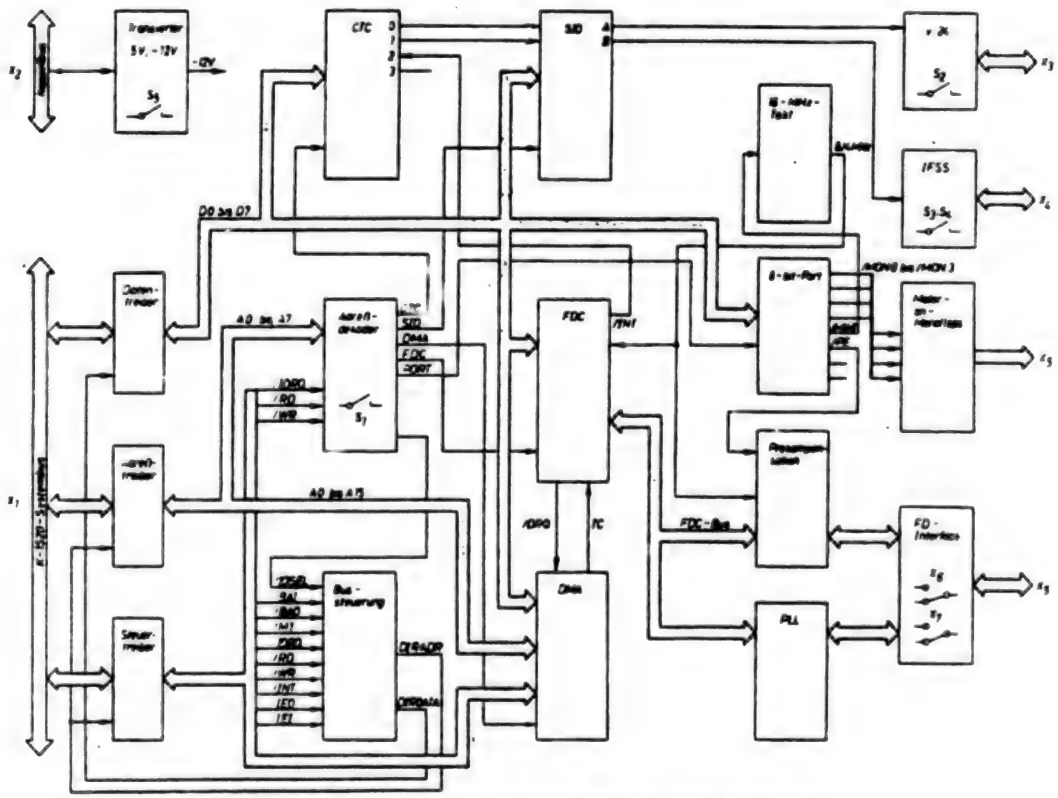

Figure 1: Wiring Diagram of the Floppy Disk Controller

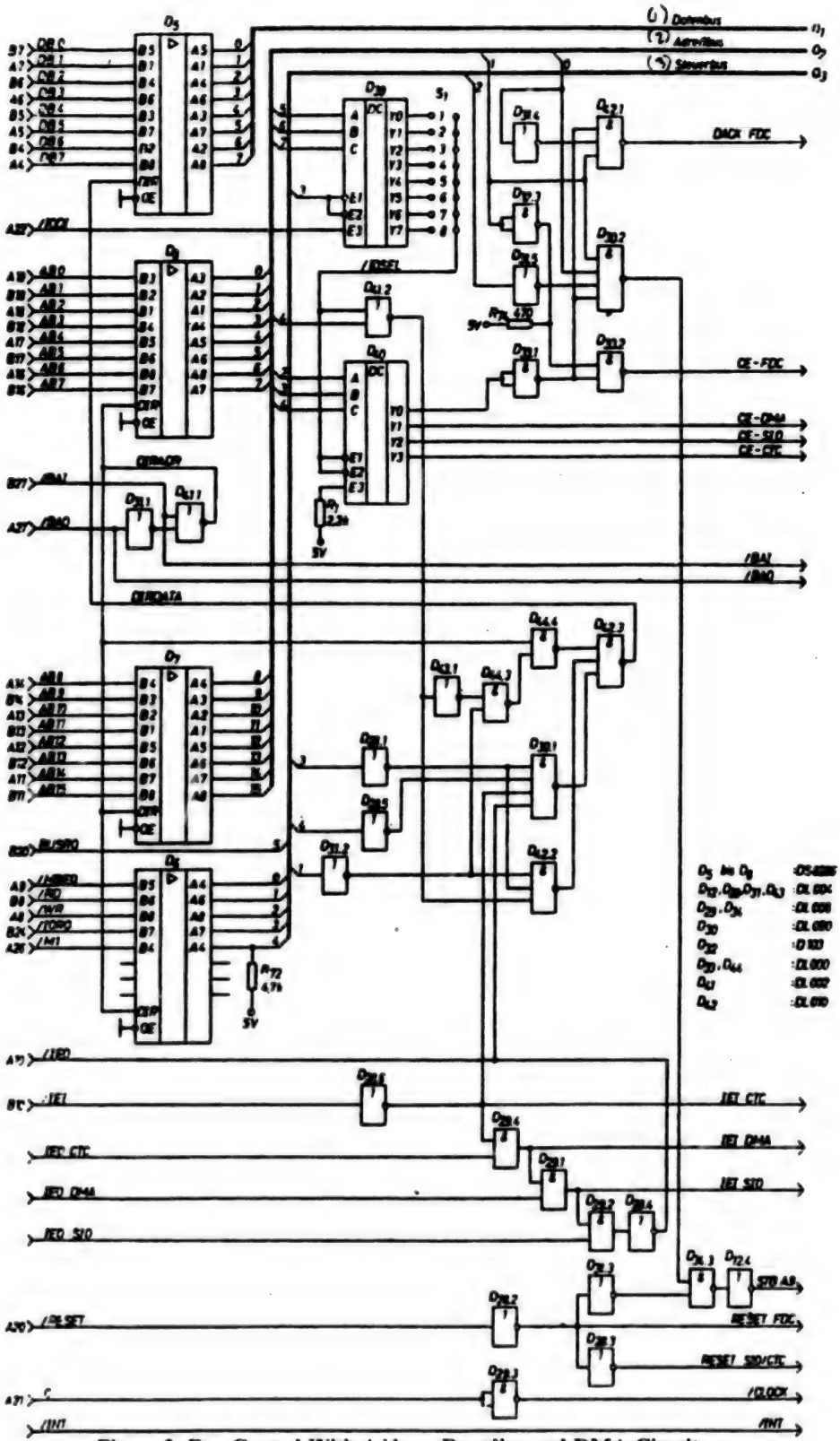

Figure 2: Bus Control With Address Decoding and DMA Circuit

Key: 1. Data bus—2. Address bus—3. Control bus

and the sending or receiving time is produced with the CTC-IS U 857. Special drive circuits match the signals to the appropriate transmission norms.

Using the IS U 8272 Floppy Disk Controller in the U 880 system requires matching the various interrupt and DMA responses. The interrupt vector of the U 8272 is provided by means of a CIC channel, and matching it to the DMA-IS U 858 occurs largely by programming the response and the control signals of the DMA operation accordingly. The timing signal necessary for the floppy disk controller is produced by one of the quartz generators, which can be switched with the software. A PLL circuit separates the timing from the data. Its operating mode is also programmable.

The signals for motor control of a maximum of four floppy disk drives are produced with an 8-bit port and are lengthened time-wise to some 5 s through four retriggerable monoflops. This port also produces the control signal for the clock generator and the PLL for matching the various recording formats. The transverter is used to produce an electric voltage of -12V for the V.24 drive switching circuit and can be switched off. To supply other users, this voltage is also in contact with the K-1520 coupling bus. The component group can also be supplied from an existing, negative voltage.

Description of the Function Groups

The circuit technology of the bus control in figure 2 shows no peculiarities. All address and data transmissions are controlled by bus drives (D_5,D_7,D_8). The same applies to the control signals (D_6), with the exception of the /BUSREQ signal of the DMA IS U 858 (D_2). This signal is continuously scanned by the DMA IS in order to recognize bus demands from other system modules and avoid bus conflicts. While the signals /BAI and /BAO are led directly to the DMA IS, the IEI and IEO signals also form a priority chain within the master card from CTC to DMA to SIO, using the Look Ahead Logic (D_{28}, D_{29}) discussed in bibliographic reference.[1]

The decoding of the component group's base address occurs via the low-order portion of the address bus linked with the /IORQ signal and can be freely selected in 20H steps (D_{39}, S_1). Decoding of the individual I-O addresses occurs with D_{40}, which results in the following correspondence:

FDC main status register	BADR + 0H
FDC data register	BADR + 1H
FDC DMA Acknowledge register	BADR + 2H
Motor port	BADR + 3H
DMA IS U 858	BADR + 4H
SIO IS U 856	BADR + 8H
CIC IS U 857	BADR + 0CH

The bus control allows the following five states:

- inactive state: no work with modules of the component group, address, data, and control bus can be read continuously on the component group.
- I-O operation: a register of the component group is addressed and read or written to from the outside (either through the CPU or other DMA module)
- INT acknowledge: a module of the component group activates the /INT signal and, upon demand, lays its INT vector on the bus
- DMA access to the outside: the DMA IS takes over the bus control and transmits data to modules outside the component group, e.g., the main memory
- DMA access to the inside: the DMA IS transmits data to a register of the component group, e.g., the SIO.

These states can be described with the following two equations:

DIRADR = BAI . /BAO (1)

DIRDATA = (RD . IORQ . IOSEL) + (MI . IORQ . IEI . /IEO) + (IOSEL + /RD) (2)
DIRADR<

where DIRADR and DIRDATA control signal transmission to the system bus, an I-O port is selected on the plate with IOSEL, and MI, IORO, RD, IEI, IEO, BAI, BAO are signals of the control bus on the plate.

According to equation (1), the signal becomes a direction circuit for the address and control drives, while equation (2) determines the direction signal for the data drives.

In terms of circuit technology, a TTL-PROM is well-suited to carrying out such relatively complex logic functions. however, because of component availability, this solution should be avoided. The most important signals of the designed circuit and its states are shown in figure 3.

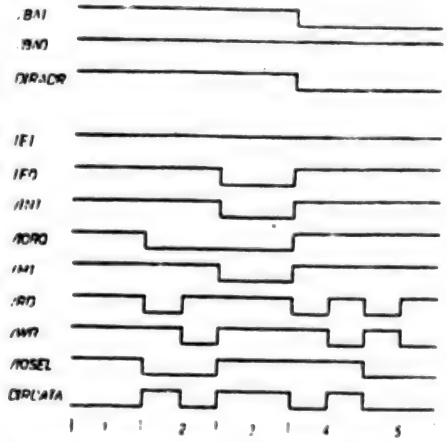

Figure 3: Most Important Bus Control States (1 inactive, 2 normal I-O operation or DMA access from the outside, 3 INT Acknowledge, 4 DMA access to the inside, 5 DMA access to the outside)

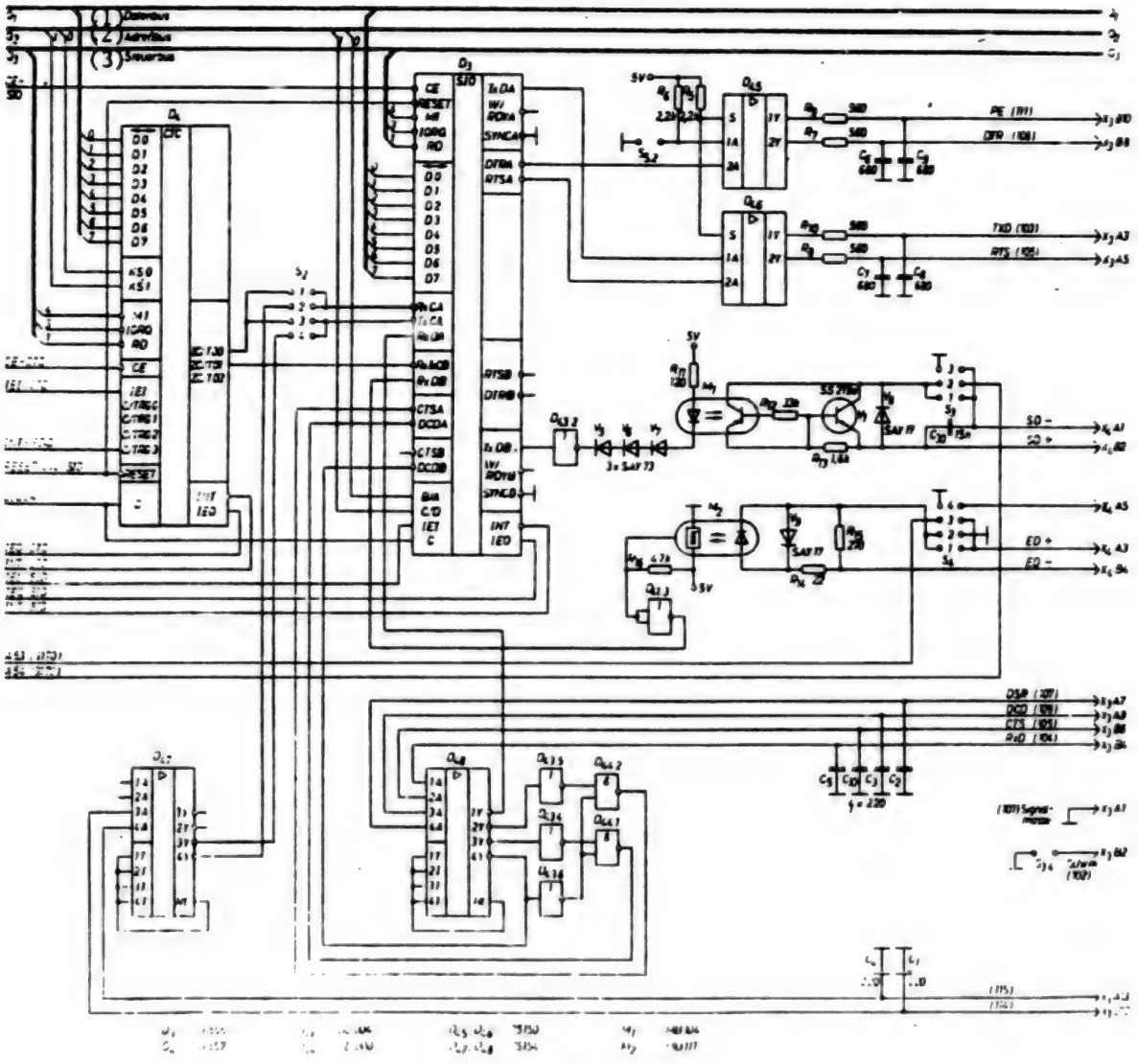

Figure 4: Serial Interfaces

Key: 1. Data Bus—2. Address bus—3. Control bus

The wiring of the DMA IS itself has one peculiarity: The /INT signal is linked with the TC input of the floppy disk controller via a gate of D_{31}. This is necessary in order to end the data transmission from and to the floppy disk drive.

Serial Interfaces

The serial interfaces (figure 4) largely correspond to the circuits mounted on the ADS K 6028 (VEB Kombinat Robotron) pin board. Channel A of the SIO U 856 (D_3) provides a V.24 interface (RS 232C). All modem control signals are present and either external or internal timing (S_2) can be used. If internal timing is selected, a CTC channel of D_4 produces a common base timing for sender and receiver. Gates can also be made for the DCD and CTS signals with the DCD signal of the SIO's B channel. Resistors and condensers protect the drive circuits D_{45} through D_{48} from overstress and HF disturbances during input and output.

The IFSS interface, considerably more simple, requires an additional CTC channel to provide timing. Sender and receiver signals are separated galvanically from the transmission line with the M_1 and M_2 optocouplers. Circuits S_3 and S_4 allow the current loop interface to be operated actively or passively. The current sources are not constructed discretely, but by using the B 3170 (N_3, N_4) voltage regulator. MB 104 optocouplers are installed on the ADS K 6028 pin board in the sender and receiver because of the higher electric strength. This notwithstanding, an MB 111 is used for the receiver in this component group, which means that the electric strength

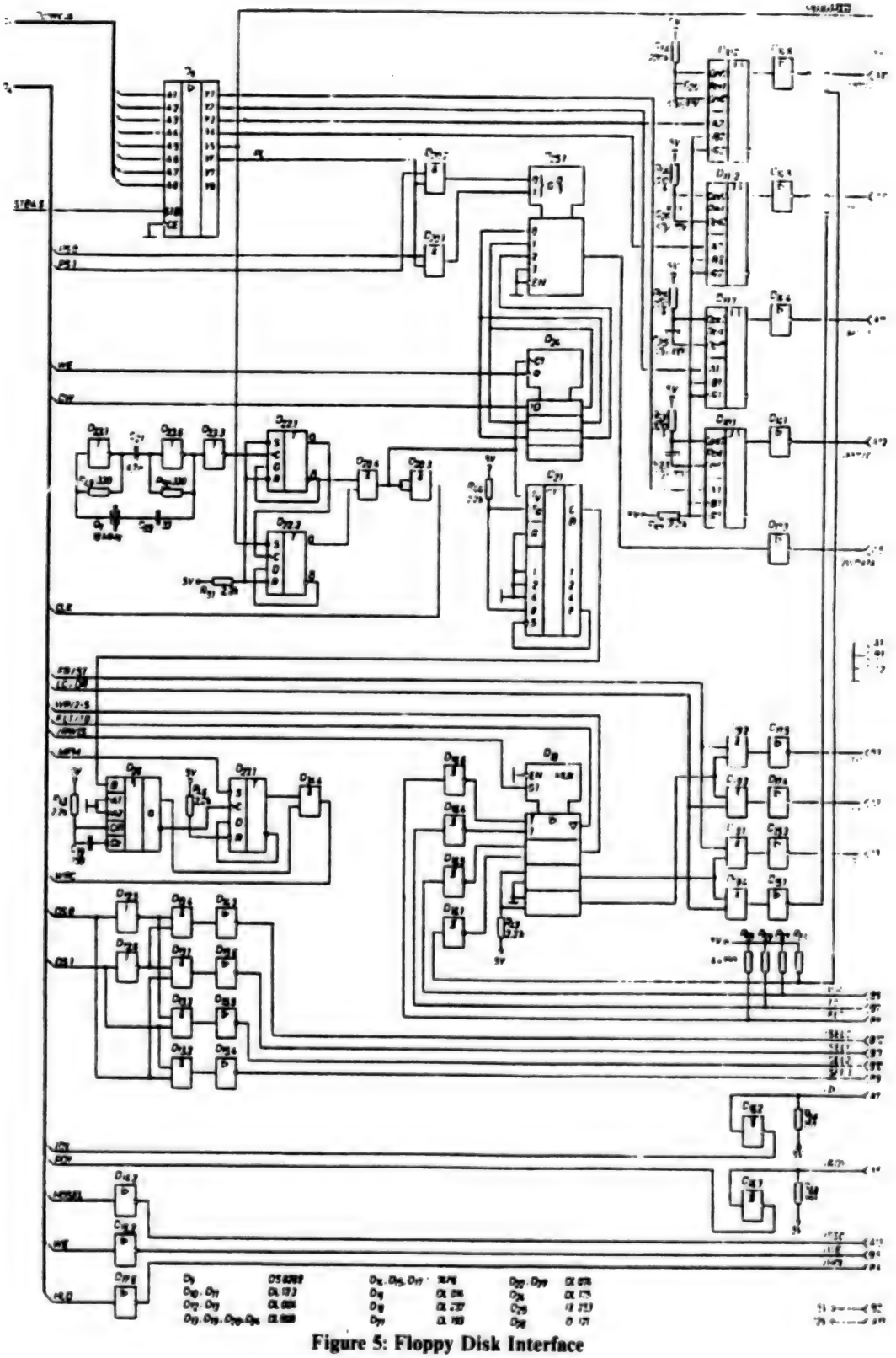

Figure 5: Floppy Disk Interface

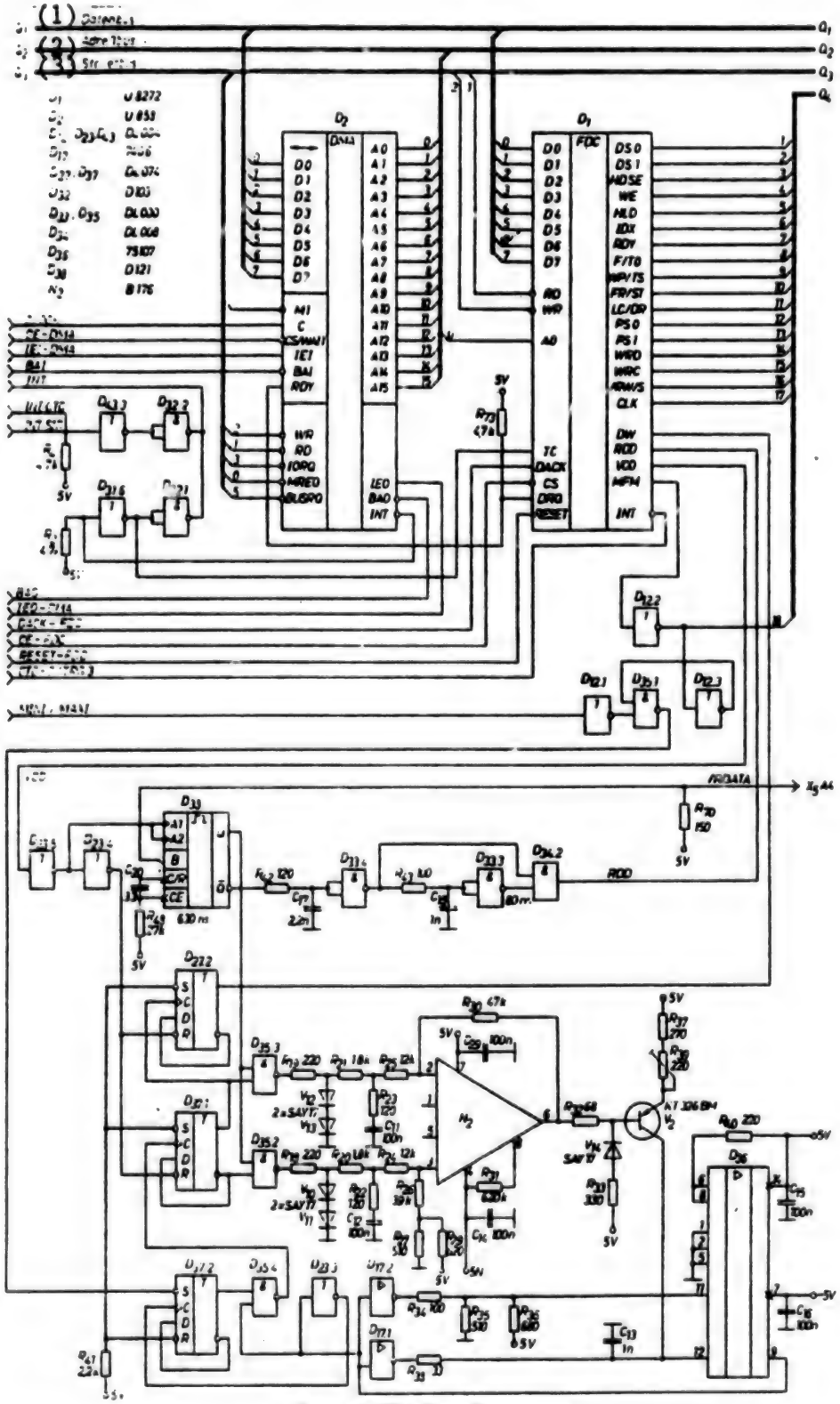

Figure 6: PLL Data Separator

Key: 1. Data Bus—2. Address bus—3. Control bus

is still sufficient, but an additional trigger after the optocoupler is not necessary (TTL output of the MB 111).

U 8272 Floppy Disk Controller With Timing and PLL (Figures 5 and 6)

In order for the controller card to be used universally, it should be connectable to 5.25- and 8-inch drives in FM and MFM formatting. This means that switchable frequency dividers are required for floppy disk controller timing and for feedback within the PLL. The timing for the controller is produced with three gates of D_{23}. Through division, 8- or 4-MHz timing is produced out of the 16 MHz timing (D_{20},D_{22}). The choice of /MINI or MAXI is made with a motorport D_9 bit, whereby the 8-MHz timing is required for the 8-inch drives or for the 5.25-inch drives with high density recording. This timing controls the floppy disk controller itself and the precompensation shift register D_{24}. The precompensation allows a temporal shift of the data pulse with regard to the write timing. The PS0 and PS1 signals of the floppy disk controller select the compensation, which can also be suppressed by a motorport bit.

D_{21} works as a 1:8 divider. From its output signal, D_{26} produces a pulse with a constant pulse length of 250 ns, from which D_{27} and D_{34} in turn produce the write timing for the floppy disk controller. While with write operations the timing comes from the quartz generator, when reading the the diskette the timing must be recovered from the data flow, for which a PLL is installed. The data pulses are triggered by D_{38} and brought to the constant length of 630 ns. The delay circuit, which consists of D_{33}, D_{34}, R_{42}, R_{43}, C_{17}, and C_{18}, shifts this pulse to the middle of the data window DW. Two gates of D_{35} compare the frequency and phase of this pulse with the output signal of the VCO (D_{36}, D_{17}). Deviations produce a control voltage for VCO via N_2 and maintain it until the PLL locks. Dimensioning the low-pass filters (R_{18} to R_{25}, C_{11}, C_{12}) is important for good control and rapid response. As a base adjustment in free running, the oscillator is set at a frequency of 2 MHz at pin 9 of D_{13} with R_{39}. According to the operating mode (FM or MFM) and timing frequency (4 MHz or 8 MHz) of the floppy disk controller and out of the phase-regulated signal of D_{13}, D_{27} and D_{37} create the data window for the controller with the following frequencies:

- 8-inch drive, MFM: 1MHz (also 5.25-inch drive with high density)
- 8-inch drive, FM: 500 kHz
- 5.25-inch drive, MFM: 500 kHz
- 5.25-inch drive, FM: 250 kHz

The last operating mode was deliberately dropped with, since it would have required another frequency divider. This would have caused additional expense due to the high component density and the already considerable component utilization.

Motor Control for Floppy Disk Drives and Floppy Interface

Because of the limited number of pins, the floppy disk controller emits some signals for the floppy disk control in multiplex operation. The /RW SEEK signal is used for switching over. It controls the choice of the corresponding inputs of D_{18} or the outputs of D_{19}. D_{14}, D_{15}, and D_{17} serve as drives for the floppy bus with efficient open collector outputs. 75450 circuits are used for this in the AFS K 5121 pin board made by Kombinat Robitron. In this solution, 7406 circuits are used because of the large number of gates per IS and the low current demand of modern drives.

The signals from the floppy disk drives are received by D_{16} Schmitt triggers with the exception of the read signal / RDATA, which is directly at the entrance of the D_{38} monoflop. With the controller in the indicated configuration, it is possible to operate four minifloppy disk drives (5.25-inch) or two minifloppy disk drives (drives 0 and 1) and two 8-inch floppy disk drives (drives 2 and 3). This requires the separation of the motor-on-signals 2 and 3 (winding pin X_6 and X_7. Now the signal /LCT for write flow reversal (FDC output) is led to the floppy disk drive and the /2-S signal (two-sided drive, FCD input) is provided to the floppy disk controller. This change-over can be dropped if the large drives are equipped with automatic write current switching and the floppy disk controller drive appropriately handles the two-sided operating mode.

-12V Transverter

Out of the 5V system voltage, the transverter (figure 7) produces a negative operating voltage of -12V for the D_{47} and D_{48} V.24 drives. A B 555 (N_1) timer circuit works as the generator with a pulse-width repetition rate of approximately 1:3. Using transistors V_3 and V_4 and output voltage is controlled via V_{16} and R_{71}. The generator can be locked with $S_{5.3}$, and $S_{5.1}$ allows the voltage

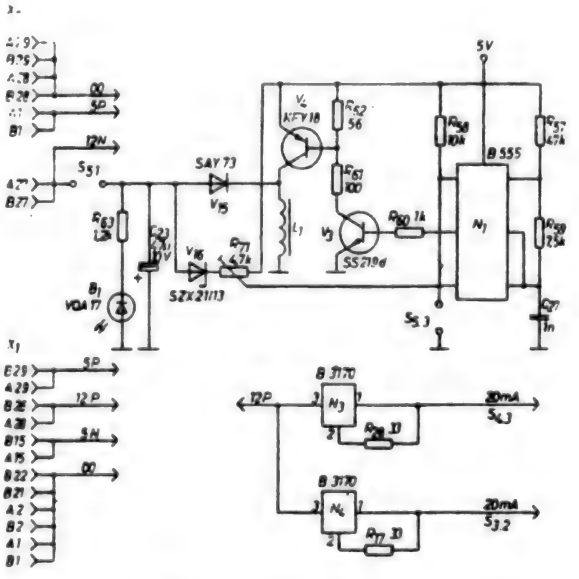

Figure 7: Transverter -12V

to be coupled with the system bus. In this way, the -12V voltage can be used on other cards as well or the oscillator can be turned off if voltage is already present.

The significance of the individual DIL circuits can be deduced from the following table.
spool L_1, a blocking oscillator is constructed whose

Significance of the DIL Circuits

Circuit	1	2	3	4	5	6	7	8	Significance
S1	on								Base address 00H
S1		on							Base address 20H
S1			on						Base address 40H
S1				on					Base address 60H
S1					on				Base address 80H
S1						on			Base address A0H
S1							on		Base address C0H
S1								on	Base address E0H
S2	on		on						V.24 internal timing
S2		on		on					V.24 external timing
S3	on								IFSS passive sender
S3		on	on						IFSS active sender
S4	on								IFSS passive receiver
S4		on	on						IFSS active receiver
S4				on					Screening on mass
S5	on								12V link, coupler condition
S5			on						Transverter off
S5		on							DIR active

Use of the Component Group in K-1520 Systems

Problems of DMA Operation With ZRE K 2521

In the K-1520 system, the controller is used with the K 2521 central processing unit and various other components. We were forced to conclude that a malfunction of dynamic memory components occurred in some of the central processing units. This defective function could be observed after a DMA operation was executed and it involved precisely defined memory cells. It was caused by spike pulses that appeared during the switching of the bus system and triggered an incomplete read cycle in the memory components. Proper functioning could only be achieved through the following change in the bus control of the central processing unit, in which $D_{15.1}$, $D_{16.1}$, $D_{37.1}$, and $D_{38.1}$ (4 x DS 8216) are separated from $D_{40.8}$ (D 204) and connected with $D_{30.8}$ (D 100).

Use With the UDOS and CP/M Operating Systems

Two operating systems based on the controller are implemented: the UDOS operating system (RIO compatible) and an operating system compatible with SCP (CP/M). The monitor program corresponds to the UDOS monitor and is capable of starting both operating systems. The loader supports all four of the driver's physical formats. The software is available as source text with the UDOS operating system and is constructed modularly, thus facilitating the exchange of device drives. The same drive sources are required for both systems. An ABS K 7024 is used for screen control. The drive is SCP compatible and also supports the international ADM 31 terminal standard. The keyboard functions with a parallel interface via the PIO on the central processing unit. It is interrupt-controlled and has a buffer. Additional programs are available to control the serial interfaces. A RAM floppy disk with a capacity of 256 Kbyte or 1 Mbyte is provided in the source of the floppy disk drive. Integration of the corresponding code is controlled with conditional translation. The RAM diskette is automatically configured by the software according to the memory insertion. Utility programs are available for formatting and format adjustment. Formatting with physical sector displacement is not supported. Reading such diskettes is possible, but results in longer access times. Automatic format recognition is not provided. The drive program currently supports only mini floppy disk drives (1.6). The following formats are provided as track formats:

- 256 byte/sector, 16 sectors/track
- 512 byte/sector, 8 sectors/track
- 512 byte/sector, 9 sectors/track and
- 1024 byte/sector, 5 sectors/track.

With these formats, 16 different physical recording formats are possible using the various combinations of one- and two-sided, and 40 and 80 tracks. It is advisable to

access the 40-track formats only in the read mode, as reading diskettes on 40-track drives that were written on 80-track drives is no longer error-free. If doing so is unavoidable, then the diskette should be formatted on the 40-track drive and should not be used after the data transfer has taken place without being reformatted.

Two additional programs are used to transfer data between MS-DOS and the various CM/M formats. They make it possible to read or write to the 360 and 720 Kbyte formats or, with a hard disk drive, the 1.2 and 1.44 Mbyte format. The version available at present, however, allows only the MS-DOS diskette's root directory to be processed. A version for processing the subdirectories is under development.

Concluding Remarks

In developing the floppy disk system, a conscious effort was made to use available components from the GDR or from the RGW field. The fact that several new components have become available in the meantime opens the door for revising individual function groups. For example, replacing the transverter with a U 7660 DC-DC oscillator would save a great deal of space, while the B 3170 of the IFSS current sources could be exchanged with the IS 75450. Low-current drain logical series can also be used, and the DL 540 and DL 541 are available as bus drives. In principle, all gates can be replaced by type 74HCTxxx IS's for dimensioning the passive circuitry.

The construction and use of the initial design has meanwhile led to a reworking of the printed circuit layout. This could remove those locating errors and dynamic problems of the PLL (read retries) that still exist.

Working out the drive for the U 8272 floppy disk controller also proved problematic. One of the main causes is its interrupt structure. With only one interrupt signal, and consequently only one processing routine, there can be several causes simultaneously. Only when all causes have been handled logically is further orderly work with the floppy disk possible. Precisely this process was inadequately presented in most of the documentation for the U 8272 or compatible IS's.

As a result of development work, the following support material is offered for later use:

- printed circuit layout, 215 mm x 195 mm format, DKL, level of difficulty IV
- assembly plan, parts list
- wiring diagram
- documentation with adjustment and format instructions
- FD drive for the UDOS or CP/M systems

With advance agreement, support on a limited scale can be provided for integration into existing systems and adjustment work. Those interested should write to:

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GDR: Subsystem Communication-LAN Development Surveyed

90WS0042A East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Apr 90 pp 29-31

[Article by Bernd Goede, PhD., of the School for Navigation, Warnemuende-Wustrow]

[Text] The computer network using modern LAN technologies has become an indispensable tool for universal practical computer application.

The demands posed by distributed computer applications on the communications solution of a network system are differentiated.

Personal computers in various processing ranges, as well as increasingly problem-specific data acquisition and output technology as the peripheral environment for personal computers, determine the qualitative spectrum of the end equipment in many distributed systems.

The real data throughput between the network nodes may definitely lie clearly below the internal memory-oriented data flow of the processing stations, if the process distribution in the system is deliberately designed for communications-poor interfaces. SCOM-LAN is the abbreviation for Subsystem Communication-Local-Area-Network. This solution, developed at the IHS Warnemuende-Wustrow by the Scientific Equipment Building Group and Computer Technology Directorate, was implemented in industrial manufacture in

cooperation with representatives from the Ernst Thaelmann Robotron Office Machine Factory VEB in Soemmerda for the PC 1715 and the PC 1715W in 1987 (2). Together with the enterprise's software center an add-on kit, consisting of an expansion assembly and several software components (system software and applications), was put together. All further developments of hard and software are fully compatible with the SCOM-LAN marketing operation of the Ernst Thaelmann Robotron Office Machine Factory VEB in Soemmerda. SCOM-LAN was inteded for a lower class of application of communications solutions. The description "lower application class" refers to demands on data transmission capacity, not necessarily to the application itself. In SCOM-LAN a suitable strategy for its use in distributed microcomputer systems has been developed. The strategy rests on considerations for process allocation, meaning for local distribution of computer processes which communicate over a local network. Preservation of extensive autonomy in the networked node systems (on-the-spot processing) is an essential feature of the application guidelines.

The modular variant of the processorless and thus hardware-minimized network interface is already supported by the concept of SCOM-LAN. Through purposeful process development of hardware-related transmission protocols, realtime-uncritical demands are placed on the host CPU. This facilitates integration of the SCOM system software into given operating systems. With the installation means as basis the SCOM hardware offers a low-cost networking base.

According to an economic study quoted under (1), about two-thirds of all current problem sets can be sufficiently solved with low-cost LANs. It is assumed that a 16-bit standard personal computer (PC-XT-AT) was used. This thesis can be confirmed by two years of experience by numerous reference users of SCOM-LAN.

There should be no misunderstanding that for other application classes— such as in the CAD and CAE [Computer-Aided Engineering] areas—there is not an equally important need for powerful networks, but in these areas the cost components are often of clearly secondary importance.

Of necessity a preferential application profile will develop for the SCOM-LAN based on its technical and economic features as well as the limits of its capability.

In the foreground of the SCOM applications are, among others, turnkey industry solutions for administrative and technically oriented data processing. The development of SCOM-LAN is intended as a supplement to other LAN developments in the GDR (ROLA-NET I, LOTU-NET, ECnet), but in particular to internationally widespread standard PC networks.

The connection of 8, 16 and 32-bit-technology network applications, as well as the integration of the simplest LAN terminals without electromechanical mass storage units (Z80/80x86 64 Kbyte main memory, RAM disk simulation, LAN boot) are clearly supported in offering the SCOM-LAN.

Foundations and Component Overview

Figure 1 gives an overview of the hardware development of SCOM-LAN. The hardware concept provides for a combination of the network interface as well as the medium connection (MAU) in an adapter assembly. Other than that, simple support drivers can generally find use in regenerating signal amplitude and signal form as pieces of equipment independent from the computer node.

In laying out the network interface unit (NIU) a progression between nonintelligent, meaning processor-less, and intelligent communications variants is possible.

The two structures must be considered differently with regard to their application profiles. The varying load data, in particular, of the consuming client stations and centralized resource stations—also described as network servers—give cause for supporting the coexistence of both expansion levels. For the 8-bit microcomputer technology, only a processor-less NIU was taken into account.

A supplementary logic for the classic Z80/U880 periphery SIO [Serial Input/Output] or for the SCC [Serial Communications Controller] protocol circuit is regarded as the hardware minimum in designing the SCOM interface units. The protocol support in the synchronous modes of operation form the starting point for SIO application.

The SIO pin outs used for the supplementary logic are RXC, RXD, TXD, RTS and DTR. Further, the hardware-related system software SCOM-NIOS demands I/O access to a channel of a programmable counter with the transmission rate (153.6 Kbit) as counting rate. The Z80/U880 peripheral component CTC is used for this.

The supplementary switching based on the SIO ports, which must be configured identically for all expansion variants in scope of function and external interface, fulfills the following tasks:

- bit-oriented receiver clock synchronization according to receiver signal,
- line driver and line receiver
- active medium connection without memory effect in the signal line
- protection and security measure (node voltage isolation as well as bypass logic for disconnecting nodes).

There is a multitude of possible switching variants for every detailed task. The interface function suitable for compatibility can be maintained with the most varied line drivers, bypass solutions and different measures for full or partial NIU voltage isolation.

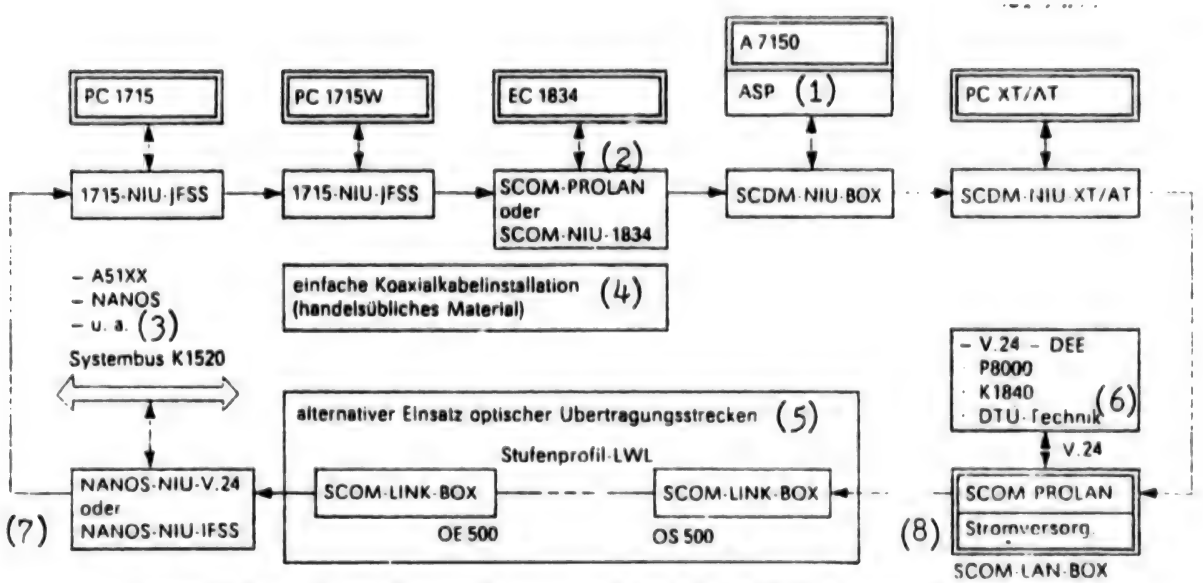

Figure 1. Linking GDR Computer Technology With SCOM-LAN Hardware Components

Key: 1. Main memory—2. SCOM-PROLAN or SCOM-NIU 1834—3. among others—4. Simple coaxial cable installation (commercially available material)—5. Alternative use of optical transmission sections; Fiberoptic step index contour—6. Remote data transmission technology—7. NANOS-NIU-V.24 or NANOS-NIU-IFSS—8. Power supply

The access logic is typical for all partial store-and-forward topologies whose elements are point-to point cabling. The unidirectional ring is the simplest practical installation form for this (Figure 2). Another topology variant was presented in (2). A solution interesting for many tasks might be SCOM porting on compact single-board computers or simple terminal stations for industrial data acquisition, measurement data acquisition and data display. The SCOM-LAN concept is intended to assure a favorable cost relation between sensor, actuator or terminal technology and the communications components precisely for these network nodes. Including personal computers in technical applications must currently be increasingly taken into account.(3)

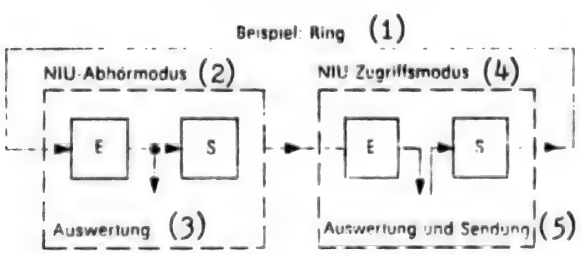

Figure 2. Principle of NIU Access Logic for Store-and-Forward LAN Sections

Key: 1. Example: Ring—2. NIU Receiving Mode—3. Evaluation—4. NIU Access Mode—5. Evaluation and transmission

Component Groups for SCOM-LAN

PC 1715 and PC 1715W

With the PC 1715 a low-cost, compact microcomputer system has been available for a few years in large production numbers.

The PC 1715W, a further developed model, demonstrates greater internal data processing capacity than the PC 1715.

The 1715(W)-NIU IFSS component group developed for the local SCOM-LAN computer network is an expansion card, which can be used both in the PC 1715 (system clock frequency 2.457 MHz) and the PC 1715W (3.993 MHz). It is placed in the corresponding expansion module plugin socket. This plugin unit contains the connection control for an IFSS [IF star-shaped serial-interface] data transmission channel and for the local SCOM-LAN computer network. The IFSS standard interface is available for free use by the PC 1715W user independent of the SCOM-LAN interface. Manufacture and marketing take place through the Ernst Thaelmann Robotron Office Machine Factory in Soemmerda.

K-1520 Technology Office Computer

NANOS-NIU is a parallel development to include modular computer technology based on the K 1520 system bus according to TGL 37271.(6) The component group has the dimensions 95 mm x 170 mm. In particular, NANO-NIU provides the basis for linking the A 51XX office computer generation. Another version is the NANOS-NIU-IFSS component group, which in addition

offers a free IFSS channel. Manufacture of this component group also takes place at DVZ/EPMR VEB (Rostock).

Another component group is offered under the name NANOS-NIU-V.24 by ITZ Ilmenau and by the Scientific Equipment Building Group of the School for Navigation. In addition to improved LAN logic, this plugin unit has a V.24 interface. The V.24 interface can be operated asynchronously or synchronously.(7)

EC 1834

Taking into account the considerably greater processing and memory capacity compared to the 8-bit PC, to begin with the EC 1834 was given an active printed circuit board with a CPU U880 A or B, up to 8 KByte EPROM and with 64 KByte or 256 KByte DRAM. Internal communications can be supported by a DMA processor.(4) The slot card measuring 300 mm x 100 mm carries the description SCOM-PROLAN. The following port variants are planned:

- PROLAN I: SCOM-LAN interface, X.21 port and V.24 gateway
- PROLAN II: SCOM-LAN interface, field bus from TUM/15/. V.24
- PROLAN III: Ports such as PROLAN II, but with direct connector to the 16-bit bus.

The PROLAN expansion card also permits, due to the free program concept and its high native processing capacity, storage of time-critical processes from the host CPU in the so-called front-end area of the personal computer.

With the PROLAN unit an intelligent X.25 interface can be accomplished for meshed packet networks through the X.21 (V.11) connection. The X.25 protocol can not only be readied as a parallel function to the host processes, but also for slow network connections via the V.24 or a logical SCOM-LAN channel. The latter applications require stand-alone use of PROLAN, as was planned with the SCOM-LAN-BOX.

Together with the Ernst Thaelmann Robotron Office Machine Factory in Soemmerda, work is under way on series delivery of the PRO-LAN component group with SCOM-LAN and X.21 interface.

For many LAN applications the passive LAN adapter SCOM-NIU-1834 (7) developed in parallel with the PROLAN card is sufficient. The measurements of the component group are 170 mm x 100 mm.

In addition to SCOM-LAN access, the component group also offers a fully implemented V.24 interface for modem connection to the EC 1834. The transmission rates of the V.24 gateway are in the range of 0.15 to 153.6 KBit/s.

In particular on LAN servers the programming possibilities of the PROLAN card with user-specific access processes can contribute to considerable savings in running time (such as access batching, synchronization of database accesses). For terminal uses around a LAN server, however, the simpler processorless SCOM-NIU is sufficient. The fact that the various expansion forms can coexist contributes to a better price-performance relationship of the LAN products.

A 7150 Personal Computer

A SCOM-NIU-BOX is intended for connection to the A 7150. This component group conceived as an external line unit is connected to the V.24 interface of the main memory adapter. The way it functions and the transmission properties of the NIU BOX corresponds with that of the passive NIU-1834. An important part of the NIU-BOX's content is the SCOM-LAN logic necessary for the U 8560 circuit.

A similar NIU-BOX was brought out under the description NIU-BOX-CZ by the Carl-Zeiss Jena combine (Saalfeld plant) in small-lot production.

PC-XT/AT With Direct Connector

Similar in construction to the passive LAN adapter SCOM-NIU-1834, but with a 62-pin direct connector, is the SCOM-NIU-XT/AT. The NIU-XT/AT delivers the same number of functions as the NIU 1834.

Use of a synchronous V.24 interface is optional. Basically, standard PC COM interfaces can be developed with the NIU-XT/AT using the additional V.24 interface.

The SCOM-LAN-BOX

The SCOM-LAN-BOX which is based on the development of the PROLAN component group, offers an intelligent V.24 interface. It is a remote terminal unit with its own power supply. The outer shell has the dimensions 320 mm x 80 mm x 120 mm.

Because of the equipment connections the LAN-BOX communications computer can be used in many different ways:

- — first of all, to connect V.24 equipment
- — as a remote V.24 printer-server in the network
- — as an intelligent V.24-I/O unit for linking remote data transmission channels (software for remote data transmission channels depends on remote data transmission channel properties in the BOX) in the service of the local network
- — to route X.25 protocol services via a V.24 or a SCOM-LAN connection.

A focal point for LAN-BOX application can also be to include additional computer types as LAN nodes (P 8000, among others).

In this context let us not forget to mention that the V.24 port acts to limit speed (often 9600 Bit/s asynchronous). But this circumstance can, as was referred to above, find

a use in the application protocol design through deliberate task distribution. The V. 24 interface in the SCOM-LAN-BOX is designed for a maximum transmission rate of 64 KBit/s in synchronous or asynchronous operation.

Use of the SCOM-LAN-BOX as printer-server is foreseen in combination with a DABANK-II-Server (central database). The DA-BANK-II not only functions as a central database but as the administrative unit of a data buffer as well (spooler). This fundamental principle can also be used with several LAN-BOX servers (several printer-servers, data transmission channels).

On the Question of Optical Waveguides in SCOM-LAN

Local computer networks with a unidirectional ring topology have the disadvantage of absolute functional dependence on cable breakage. On the other hand, there is the advantage of uncomplicated design of the individual transmission channels in the point-to-point structure of the network. Another important advantage is also that heterogeneous forms of transmission may be included without problem. In this context optical waveguides play a well-known, special role.

The use of optical fibers with step index contours for short-distance transmission was tested in some SCOM-LAN installations.(5) The cable manufacturer is the Oberspree Cable Works VEB in Berlin. Further, transducer modules according to (5) and types OS 500/ OE 500 from VEB KEAW in Berlin were also employed in the technical realization. Transmission paths of about 2,000 m between individual network nodes were spanned. The mixed use of coaxial and fiberoptics sections proved particularly valuable, in which the coaxial cable sections have a positive influence on the flexible connection layout by the user (office, laboratory operation). As a result of the experience gathered from the operation, a small equipment unit with the name SCOM-LINK-BOX, remote from the LAN-NIU, was created. Switching the electrical transmitter and receiver assures connection compatibility with all SCOM construction groups. In addition to the fiberoptics connection, the SCOM-LINK-BOX offers the choice of function of an auxiliary driver with voltage isolation for two coaxial cables. ITZ Ilmenau offers a SCOM- REG signal generator for SCOM.

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More Computer Viruses Noted in Hungary

25020014A Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 26 Apr 90 p 13

[Article by Janos Kis: "Forecast"]

[Text] The Antivir group of Szolinfo—now using this name—will continue to report regularly about program viruses endangering domestic computers.

Viruses have proliferated significantly recently. What is characteristic is not so much their mass appearance as rather the multiplicity of types. Program viruses which were unknown earlier but which still can be called standard have appeared, without any antecedents. The ping-pong virus, one of the Boot viruses, has appeared on a massive scale. This attacks the boot sector of the disk, but only on XT computers since it is written in the internal code of the 8085 processor which the 8086 understands very well. (It cannot get into the hard disk of an AT.) If we don't make use of the PC when it is turned on then a ball appears on the screen and bounces back and forth among the letters.

We have written in detail about one of the two relatively new viruses, "Ivan the Terrible" also known as Victor. If we do not detect it in time, it can cause serious damage by destroying files. Versions of the PRGDOKI virus killer program above version 3.02 will eliminate it. New versions of this anti-virus system are appearing more quickly, often every two weeks, because of the many newly appearing viruses. Registered users are notified by letter or telephone about each new version, in accordance with the contract, and they can decide if they need it when they know the expansion.

Another new item belongs among the internationally known virus strains. People from the group have isolated it in Szolnok. Its name is Vacsina; its length is 1,206 or

1,207-1,213 bytes, depending on the paragraph boundary. It has a part which remains in memory, and remains in memory when one restarts, this is not a real restart, with the CTRL-ALT-DEL keys. Only the main switch and the RESTART key are effective! During restart it plays Yankee Doodle, the American song, with frenetic amplification, giving the user a box on the ears. It infects COM, EXE and Overlay files. They are working on an antidote.

Hungarians Develop Novell-DECnet Gateway System

25020014C Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 3 May 90 p 18

[Unattributed article: "A New Concept in VAX/ PDP-IBM PC Networks"]

[Excerpts] Network software developed in Hungary and based on a new concept is increasingly popular among DEC users. The Novell-DECnet Gateway (NDG) system offers uniform file and database management services for programs running in a network of DEC compatible (VAX, PDP, TPA) and IBM PC compatible computers.

The first version of the system (still known as the Remote Request Control System) was described in May of last year by the authors of the software, Geza Malics and Gyula Szucs, at the DECUS HLUG conference held in Sopron. Then we met with the RRCS as a leading product of Hardex Limited at the fall Compfair '89, where it won a fair prize. But at the same exhibit a newer version, known as NDG, appeared at the stand of several exhibitors and it is becoming better known thanks to its services supporting database management and network gateway functions.

The developers of the system reported on the most recent developmental achievements at the DECUS HLUG conference held in Hajduszoboszlo 26-30 March this year. They also described the first signficant user system based on NDG, a county level personnel records system developed for a VAX-PC network. [Passage omitted]

The NDG makes it possible for programs developed for and running on PC's to open, close and access at the record level all data files in the network, so the functions of the software managing the data files of a DEC computer linked into the network can be used as well. By using NDG the conversational programs of the system can run on PC's while batch processing is done on the DEC computer. [Passage omitted]

So the NDG offers more than, for example, KERMIT, which provides transmission at the data file level. It has a different task than DECnet (the services of which are used by NDG as an option) because it offers substantially higher level file and database services. Finally its concept is opposite to that of the NetWare-VMS software because it uses VAX as a Novell server in the network (extending to it the possibilities of the PC software). In contrast to this the NDG extends the services of the file management and database systems running on the VAX (or PDP) to the PC's and the network of them. At present the NDG is the only software which makes it possible for PC's and VAX (PDP) operating in the network to have file and database access at the same level at the same time in the environment described.

The services of the system can be used when using Clipper, dBASE, Turbo C and Microsoft interpreters.

The NDG offers something new in switching topology also because in addition to the customary asynchronous line (RS-232) and Ethernet based connections it makes a gateway connection possible as well. The essence of this is that in an NDG network it is enough to link one of the workstations of the Novell network to the VAX (PDP) computer. Through this gateway computer the system will serve the requests of all the work stations in the Novell network, substantially reducing the costs of building up the network. [Passage omitted]

Programs developed with the NDG are portable in the case of an asynchronous, Ethernet or gateway type network link! The NDG "recognizes" what sort of computer it must work on based on what sort of network hardware link. [Passage omitted]

Further development of the NDG is expected during the summer. The new version (V 3.0) will make it possible for programs running on VAX (PDP) to access the data files of the PC's and will greatly increase user possibilities thanks to UWF (User Written Functions, functions defined by the user). [Passage omitted]

Hungarian Publisher Links IBM Compatibles to Macintosh'es

25020014B Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 3 May 90 p 5

[Article by Gabor Revesz: "DTP at 7LAP"]

[Text] A new journal, a new electronic editing system. As far as we know the radio and television program guide weekly 7LAP has the first computer system in Hungary where IBM PC compatibles and Macintosh computers work in a common local area network. System owner Imre Kohidi put together the ideas of the editors for experts from Computer Media. Deputy director Zsolt Keresztely directed the project for Computer Media, which was prime contractor for the system. Office chief Geza Szilagyi undertook development and integration of the image processing subsystem. The value of the investment is 65 million forints.

The 7LAP system is built around a 33 megahertz 386 server with 600 megabytes background memory. The system has network hardware based on Ethernet. The network software is Novell NetWare version 2.15 and a supplementary NetWare for Mac system. The applications software is based on the Redaktor editing program of Computer Media.

Only the text recording stations are 286 based computers, which work with a Hungarian version of XyWrite. There is a matrix printer for every computer. The editors also work with XyWrite on 80386 computers. The typesetting stations are also 80386 computers, with an ETAP A/4 monitor and Ventura Publisher version 2.0. A 386 AT serves graphic design work, with an ETAP PICTOR color graphics monitor, digitizing tablet, mouse and GEM Artline and GEM DRAW Plus software—for preparing drawings which can be produced with vector graphics.

The video pictures, photographs and slides are processed by Macintosh computers. The paper image reader prepares 24 bit RGB color image files with a resolution of 900 dpi in three to eight minutes depending on picture size from paper images and three dimensional objects. The slide reader can receive 35 mm slides. Its resolution is nearly 5000 x 7000 pixels and the average read-in time is one to two minutes. Here also the result is a 24 bit RGB color image file. The video reception station can perform real time digitization of video signals from PAL, VHS, S-VHS and RGB sources. The link receiving the video signal also controls a 32 bit color monitor. So this file contains a 32 bit RGB color image. Retouching is also done by computer. Color correction and color separation takes two to five minutes per picture.

There is a multi-task system at the printing stations. The system serves the printers—A/4 laser printers with a resolution of 800 X 400—and the projectors and it performs the color separation.

Because of their size the picture files are stored on the server in compacted form with the aid of a special program. The server contains the picture files, separated by color, and a compacted black-white copy used for setting up and preparing copy. Monotype Prism 300 equipment is used for projection.

We asked editor-in-chief Istvan Sandor about further development of the system. He said that its image processing capacity may prove narrow compared to the ample text processing capacity so it will be developed. At the moment trouble is caused by the long digitization time for A/4 size paper photos. So often they use slide input or use the capacity of outside firms.

Hungarian Firm Offers Image Analysis Software

25020015 Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 22 Mar 90 p 1

[Article by Zsuzsa Szekeres: "SZKI Pixel"]

[Text] In January the Mathematics Laboratory of the SZKI [Computer Technology Research Institute and Innovation Center] became a corporation under the name SZKI Pixel. Its founding capital is 14.6 million forints, four percent of which is made up of employee shares. According to its plans, a part of the 96 percent making up the property of the SZKI will be sold to foreign partners in the future—retaining a majority interest for the SZKI. According to Jozsef Szabo, business director of the corporation, it now has 30 workers. Its experts have been dealing with image processing for more than 10 years.

The tools needed for image processing can already be obtained in PC categories. They have prepared two significant software packages in this area. The first was the Prima (PRoper IMage Analysis) general purpose PC based image processing system developed under the leadership of Csaba Hegedus. They have been selling it since 1988, for 250,000 forints. They have sold 40 to 50 copies, bearing the KAF [Forum of Outstanding Goods] emblem, ten of these to the West and ten to the Soviet Union. They usually deliver the systems together with supplemental hardware elements, an image digitizing card, CCD camera and monitor. Their domestic customers include the Astronomical Research Institute, Ikarus, the MAV [Hungarian State Railways] Hospital and Tungsram. The typical applications areas for the software are evaluation of medical X-ray, ultrasonic, etc. pictures, non-destructive material testing and evaluation of air and space photographs.

As a modern device they have fitted to the system a flatbed reader, a Microtek 300 C was the first. At present they are working on connecting Prima to fast parallel devices (transputer and cell processor).

Since mid-1989 they have had a new product, Pigalle (electronic PIcture and text GALLEry), an image and text database management system developed by the department of Jozsef Kophazi jointly with the Computer Media Company. The database can contain high resolution color pictures and the textual information which goes with them. The image information is stored in a specially coded, compacted form; it can store each picture with simultaneous use of 256 or 32,000 shades of color. The space photographs kept at the BME [Budapest Technical University] were catalogued with the aid of the system. They have sold four copies of the software on the Western market and the Soviet Union has purchased one copy. The price of the software is 500,000 forints.

Record keeping for tourism, realestate sales and museum holdings promise to be good applications areas. They will introduce new versions in the near future. These will include versions which are simpler and cheaper than the original but there will also be more complicated ones. For example, they will offer a version in which special devices are needed only to take the picture, but if the customer desires then the corporation will do this also as jobwork.

One goal of making the laboratory into a corporation—and hopefully this will be the result—is to shorten the decision-making paths, increase the interest of the workers and finally to be able to stand on their own feet. The organization of marketing is becoming increasingly important so they have employed a marketing expert to find customers and users for the image processing software, which embodies great intellectual value. The Pixel

Corporation has considerable Western export work and project undertakings and these must be expanded further this year because their earlier significant Soviet export has become uncertain today. In the future they will strengthen their hardware marketing activity; thus far they have sold devices connected with image processing only to those who also purchased software. Hereafter the two will not necessarily be tied together.

LASERS, SENSORS, OPTICS

GDR: New Microstructure Analysis Technique Developed

90P60034p East Berlin TECHNISCHE GEMEINSCHAFT in German No 6, 1990 p 23

[Summary] Present methods of microstructure analysis, such as scanning electron microscopy and scanning tunnel microscopy provide information only about the outer surfaces of test samples. With a technique developed at the Technical University Berlin, it is now possible to make "embedded" interfaces in semiconductors visible. The method, based upon the phenomenon of raster cathode luminescence and developed by Professor Dieter Bimberg and his colleague, Juergen Christen, makes it possible to identify structures at embedded boundary surfaces. The new process also permits single atom resolution in the vertical plane.

SCIENCE & TECHNOLOGY POLICY

Polish "Silicon Valley" Developing

90P60035p Leipzig URANIA in German Jul 90 p 29

[Summary] (Poland) A large complex of electronics plants and research facilities in the region of Torun, itself a producer of integrated circuits (ICs), is beginning to shape up as the Polish "Silicon Valley." That this region was selected for research, development and production is no mere happenstance, given other Polish cities north and northwest of Torun which are also contributing to this concentration of effort. For example, Bydgoszcz manufactures electronic devices and modules; Gdansk produces products for use in electronics and telematics, individual components and modules; Gdynia provides professional electronics systems and software; and, Koszalin supplies components for semiconductor production. With boosts in production already in evidence, these regions are expected to provide 120 million ICs and sensors, within three to five years.

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